BIOLOGICAL ASSESSMENT

SR 532 Corridor Improvements: Camano Island to Interstate 5, Design-Build, East Section

Snohomish County, WA
WIN # A53210G

Prepared by
Northwest Region
Environmental Services

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Washington State
Department of Transportation

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Washington State Department of Transportation

Northwest Region

BIOLOGICAL ASSESSMENT COMMITMENTS

Full Project Title:

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Completion of this project will require stipulations beyond standard practices and precautions set forth by the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction 2006. The following obligations are derived from best available science, and are important to ensure ESA compliance. The Design and/or Construction Engineering offices have acknowledged that these provisions will not compromise project design or construction.

1. The project work will occur below the OHWM of Pilchuck Creek between July 1 and September 30 or in accordance with the work window established by the WDFW Hydraulic Project Approval.
2. If additional staging areas are proposed outside of the original project footprint, the project engineer will contact Andrew Gross at 206-440-4951 to evaluate potential impacts to sensitive areas and listed species.

EXECUTIVE SUMMARY

The Washington State Department of Transportation (WSDOT) proposes to provide safety and congestion relief improvements for 6.17 miles of State Route (SR) 532 from 270th Street NW to 72nd Avenue NW, MP 3.72 to MP 6.36, and 64th Avenue NW to 12th Avenue, MP 6.36 to 9.89, in the city of Stanwood and unincorporated Snohomish County, Washington. Proposed work will include installation of new truck lanes, turn lanes, and driveway modifications to help ease traffic congestion. The project will proceed under a design-build model.

This project is entirely state funded; however, project construction requires a U.S. Army Corps of Engineers Individual Permit, creating a federal nexus under the Endangered Species Act of 1973, as amended. WSDOT biologists visited the project area, reviewed best available science, and communicated with local experts to document listed species in the project vicinity. They reviewed proposed construction activities and assessed how the project may affect listed species and their designated critical habitat in the project action area.

Puget Sound Evolutionary Significant Unit Chinook salmon *(Oncorhynchus tshawytscha)*, Puget Sound/Coastal Distinct Population Segment (DPS) bull trout (*Salvelinus confluentus*), and Puget Sound DPS steelhead *(O. mykiss)* and their designated critical habitats may occur in the project vicinity.

Church Creek (WRIA 05.0019; HUC 171100080304) tributary to the Stillaguamish River has documented steelhead use and supports potential use by bull trout. The Stillaguamish River is designated as critical habitat for both Chinook salmon and bull trout.

The project will avoid and minimize impacts to listed aquatic species during construction with the use of Best Management Practices and a scheduled in-water work window. All in-water work will be conducted between July 1 and September 30 in accordance with the expected timing restrictions from Washington Department of Fish and Wildlife.

After a full review of field observations, best available science, and project plans, WSDOT concludes that this project **may affect, is not likely to adversely affect** bull trout, Chinook salmon, and steelhead. The project will have **no effect** on designated critical habitat for Chinook salmon and bull trout. WSDOT has reviewed the project in accordance with the Magnuson Stevens Fisheries Conservation and Management Act, reauthorized in 1996 and has concluded that the project will **have no adverse affect** on Essential Fish Habitat.

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INTRODUCTION

The Washington State Department of Transportation (WSDOT) proposes to improve safety and congestion on State Route (SR) 532 under a design-build construction model in unincorporated Snohomish County. Proposed improvements include the installation of new truck lanes, turn lanes, and driveway modifications to help ease traffic congestion and reduce traffic collision potential along 6.17 miles of SR 532 between MP 3.72 to MP 9.89 (Figure 1).

The proposed action does not include federal funds, but it does require a U.S. Army Corps of Engineers Individual Permit; therefore, it has a federal nexus under the Endangered Species Act of 1973, as amended. WSDOT prepared this Biological Assessment (BA) in accordance with section 7(c) of the ESA. The BA has been prepared to determine proposed impacts to listed species and their designated critical habitat and to coordinate with the United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). The BA includes an analysis of Essential Fish Habitat in accordance with the Magnuson Stevens Fisheries Conservation and Management Act, reauthorized in 1996 (Appendix A).

PROJECT DESCRIPTION

The proposed project will provide safety and congestion relief improvements for SR 532, MP 3.72 to MP 9.89. The installation of new truck climbing lanes, turn lanes, and driveway modifications will help reduce the potential for collisions and traffic congestion (Appendix B).

The planned road improvements include:

- Between 104th Dr NW and 98th Dr NW, access management and pedestrian improvements.
- At 102nd Ave NW, add c-curb on the east and west legs of the intersection. The c-curb will extend easterly from 102nd Ave to Camano St. and westerly from 102nd Ave to just west of 103rd DR NW.
- Close alley access (50’ west of Camano St.) to SR 532.
- At 98th Ave NW, construct west bound left turn lane.
- At Pioneer Hwy, construct right turn lane for east and west legs and left turn lanes for north and south legs.
- At Olympic View Place/ Pioneer Hwy, close Olympic View Place and provide alternate access.
- Beginning at Pioneer Hwy construct east bound truck lane terminating in a right turn lane at 72nd Ave NW.
- At 72nd Ave NW, construct a right turn lane for east leg and right turn and left turns for north legs.
- At 268th St NW/72nd Ave NW, realign 268th away from SR 532/72nd Ave NW intersection, or cul-de-sac 268th St NW.
- Provide pavement overly between MP 3.72 and 5.93, except across RR bridge.
- At 64th Avenue NW, construct left-turn channelization and right-turn tapers on the east and west approaches.
- At 52nd Ave NW/ Sand-Gravel Driveway, lengthen the westbound left turn lane to accommodate trucks, lengthen the eastbound right turn lane, and add an eastbound and westbound acceleration lane.

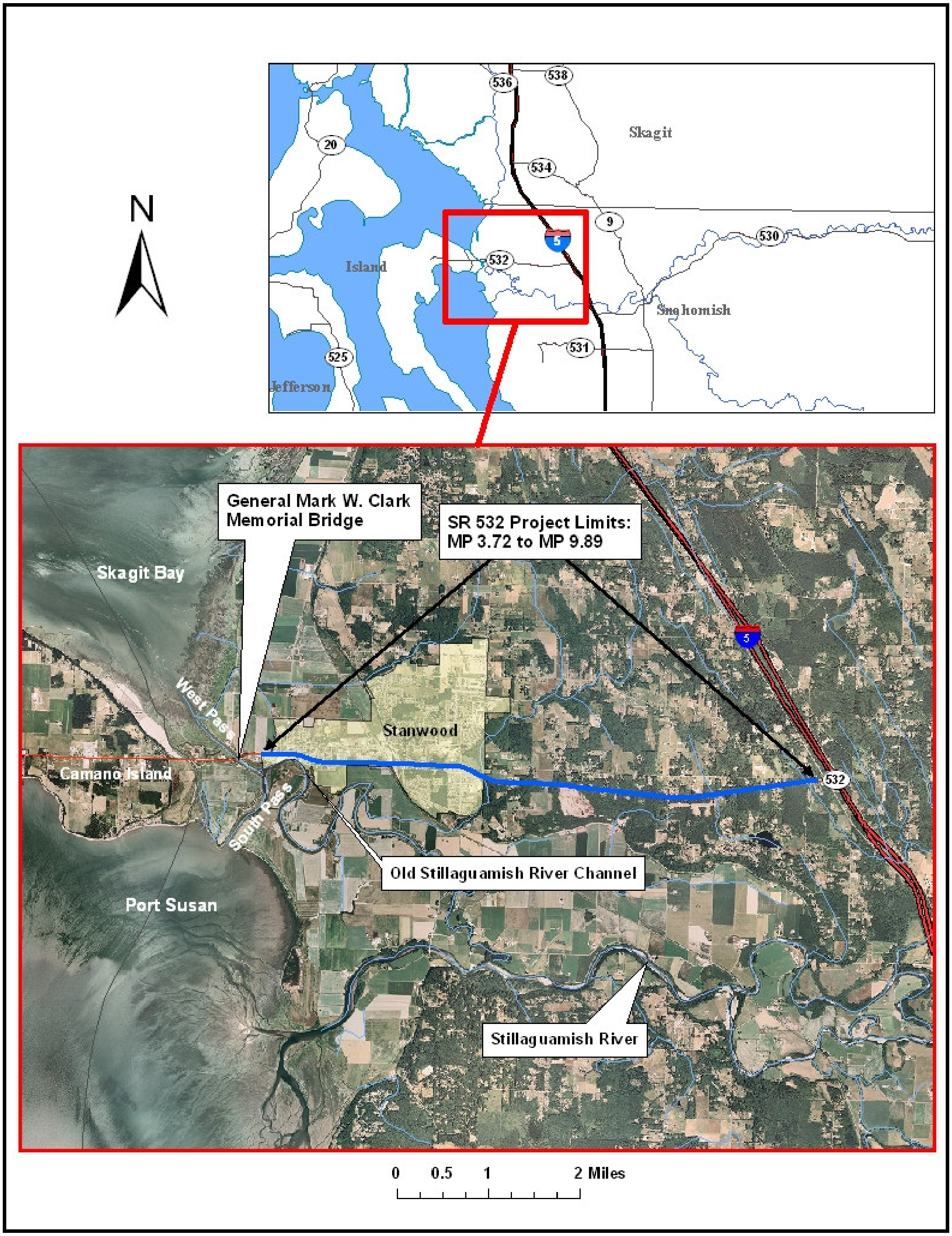

Figure 1. SR 532: 270th St NW -12th Ave NW Vicinity Map

- At 36th Ave NW, construct left-turn channelization and right turn tapers on the east and west approaches; restrict north leg to right-out only.
- At 28th Ave NW /Sunday Lake Rd, construct left-turn channelization and right turn tapers on the east and west approaches and improve the northbound turning pocket.
- At 12th Ave NW, construct a left-turn channelization and right turn tapers or pockets on the east and west approaches. Construct a right-turn pocket on the south approach.
- Add widening for a westbound climbing lane between 28th Ave NW and 12th Ave NW.
- Add widening for an eastbound climbing lane between 52nd Ave NW and 36th Ave NW.

Project Location

The proposed safety corridor project is located in the city limits of Stanwood and in unincorporated Snohomish County, Washington, within Township 32 North, Range 3 East, Sections 23, 24, and 25 and Township 32 North, Range 4 East, Sections 19,20,25, 26, 27, 28, 29, and 30. SR 532 is classified as a rural collector in the project area (WSDOT 2007).

The project corridor lies within the following three 6th Field Hydrologic Unit Codes (HUC) of the Lower Stillaguamish Watershed: Lower Pilchuck Creek (HUC 171100080303), Hat Slough (HUC 171100080305), and Mouth of Stillaguamish River (HUC 171100080304). Work associated with this project will occur in portions of all three HUCs, but in-water work will be limited to the Hat Slough (HUC 171100080305) and Lower Pilchuck Creek (HUC 171100080303). All streams affected by the project are located in WRIA 5, the Stillaguamish River Basin. Several of the tributary streams with in the project corridor are unnamed, unmapped, and are not classified under the WRIA system. These streams have been identified by attaching suffixes (a), (b), (c), etc. to the number of the closet WRIA- numbered stream in this report.

Project Overview

Constructing the proposed improvements involves various construction activities on SR 532 within the existing and newly acquired WSDOT right-of-way and will:

- Construct 1.7miles of truck climbing lane;
- Install retaining walls;
- Install turn lanes at multiple intersections;
- Modify driveways;
- Provide pedestrian improvements;
- Install stormwater features; and

Anticipated Construction Schedule

The project will be advertised for design-builder bids in October 2008. WSDOT anticipates construction will begin in summer of 2009 and be completed in mid 2011. Offsite mitigation construction is expected to begin in the summer of 2008. There are no timing restrictions associated with this project other than the in-water work period for the mitigation site. There are no other listed wildlife species or suitable habitats to support these species within the immediate project area that would benefit from work restrictions.

Although ultimately determined by the design-builder, WSDOT anticipates the order of project work to be as follows:

Construction Phase	Start Month/Year
Demark clearing limits and install High Visibility Fencing	May, 2009
Construct temporary erosion and sediment control (TESC) structures and install BMPs	May, 2009
Clear and grub project	May, 2009
Construct retaining walls	June, 2009
Construct roadway sections and stormwater facilities	June, 2009
Install lamination, pave and stripe roadway, and install traffic signs	June, 2009
Restore roadside with vegetation	2009 through 2011
Remove all BMPs	2010 through 2011

Anticipated Construction Equipment

Construction equipment required for project construction includes but is not limited to:

- Excavators
- Bulldozers
- Loaders
- Compactors
- Dump trucks
- Backhoes
- Planers
- Paving machines and striping trucks

Project Footprint

The construction activities related to corridor improvements will involve clearing, excavation, and placement of fill. There are 39.13 acres of impervious surface currently in the immediate project area. The project will create 5.23 acres of new impervious surface, for a total of 39.66 acres.

Disturbance to Vegetation

Clearing and grubbing is required for the construction of two truck climbing lanes, turn lanes and intersection improvements. Approximately 67,000yds^3 will be excavated and approximately 15,000 yds^3 of fill will be used in construction. Approximately 10.11 acres of upland vegetation, mostly roadside grasses and shrubs, will be removed. Construction will unavoidably permanently impact 9.51 acres of sensitive areas: stream buffer (0.11 ac.), wetland buffers (5.8 ac), and wetlands (3.6 ac).

Restoration

Re-vegetation of all temporarily cleared areas along the project corridor outside stream and wetland buffers will be completed in accordance with the Roadside Manual (WSDOT 2003) and the Roadside Classification Plan (WSDOT 1996). Disturbed areas will be hydro-seeded and then, if applicable, replanted with native tree and shrub species.

WSDOT proposes to use compensatory mitigation to offset unavoidable impacts to wetlands and buffers at an offsite location on the Stillaguamish Tribe's property within the Pilchuck Creek watershed approximately 2.4 miles south of the SR 532 project corridor (Figure 3). Proposed mitigation components within the Pilchuck Creek site include wetland creation and enhancement, riparian restoration, and off-channel habitat creation. The Stillaguamish Tribe will be the design lead on the mitigation site and will coordinate with WSDOT to ensure that mitigation requirements are met. Design plans are currently in the conceptual phase, as more hydrology data is needed. Construction is expected to begin in the summer 2008.

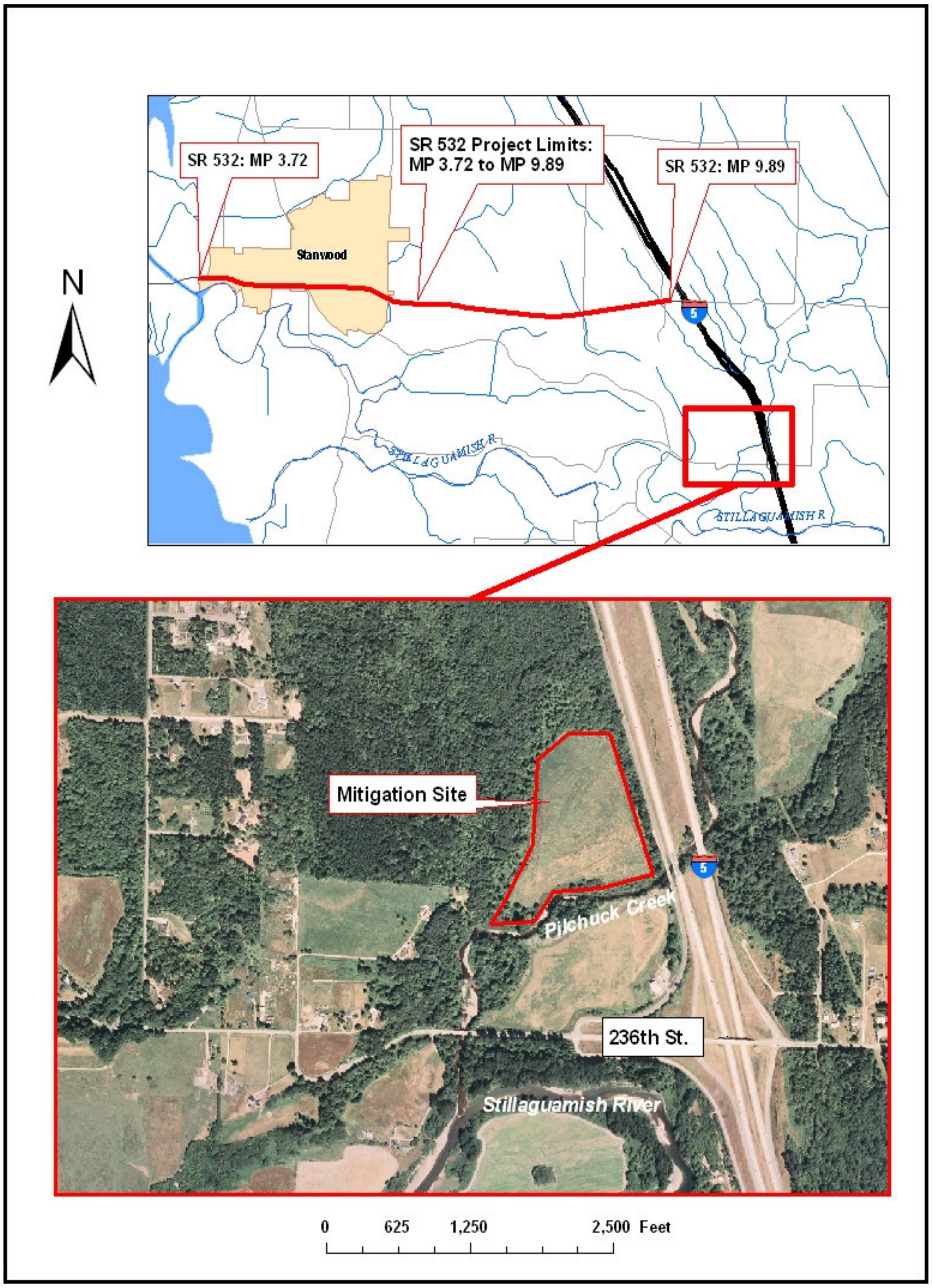

Figure 2. Pilchuck Creek Mitigation Site

Site Preparation

The first stage of construction involves marking the construction boundaries, installing temporary erosion and sediment controls (TESC), mobilizing and staging equipment, and clearing vegetation.

Temporary Erosion and Sediment Control

The contractor shall submit a TESC plan that specifically addresses equipment and site issues for approval by the Project Engineer before beginning any work, particularly in-water work. Once the plan is approved, the Contractor will install best management practices (BMPs) which WSDOT will inspect before any earthwork can commence. WSDOT environmental and project inspectors will monitor BMP installation and construction techniques to ensure compliance with applicable regulations.

The plan shall include erosion control methods that will prevent silt-laden water generated from any land-disturbed areas, including temporary access roads or staging areas, from entering streams within the project corridor. The plan could include, but is not limited to, storm drain inserts, compost socks, silt fences, filter fabric, temporary sediment ponds, check dams of washed pea gravel-filled burlap bags or other material, diversion dams with flexible drainage pipe outfalls and pumps as necessary to divert flows and mulching of exposed areas. The Contractor shall also implement appropriate BMPs to prevent equipment from tracking debris onto SR 532 and adjacent arterials.

High-visibility fencing will delineate all clearing limits and sensitive areas. In addition, signs will label all streams, wetlands, and their buffers near clearing activities. Excavation sites near sensitive areas will be separated by temporary silt fences and high-visibility fencing. The silt fences will prevent sediments or other materials from leaving the disturbed area and entering protected sites. Similar protective fencing will be installed around sensitive areas in the immediate project area including streams, wetlands, and their buffers not scheduled for project related disturbance. Likewise, measures such as silt fencing and high-visibility fencing will protect sensitive areas adjacent to staging areas.

WSDOT will use BMPs to control turbidity and sediment releases during construction. BMP’s include installing storm drain inlet protection into existing catch basins up to 100 feet down gradient from project construction limits. Interceptor ditches, geotextile-encased check dams, and other control facilities may be installed to catch runoff water and direct it to temporary sediment ponds.

Spill Prevention, Control and Countermeasures Plan

The Contractor will write a Spill Prevention Control and Countermeasures (SPCC) plan describing the management of any potential spills and submit to it to the Project Engineer for approval. The Engineer must approve this plan, with any related supplements, before construction begins. The plan must identify all construction planning elements, potential spill sources, and measures that the contractor will take to prevent hazardous material releases or spreading. The Contractor must maintain all equipment and material designated in the SPCC plan at the project site.

Stormwater Design

Stormwater Impact Area

The entire project is located in the Stillaguamish River basin. The watershed encompasses about 720 square miles in Snohomish and Skagit County and is the fifth largest tributary to Puget Sound. The mainstem of the river enters Puget Sound just west of the city of Stanwood. Stanwood has three distinct drainage regions: Douglas Slough Basin, Church Creek Basin, and Irvine Slough Basin, all of which eventually discharge into the Stillaguamish River. The Douglas Slough Basin encompasses the northern section of Stanwood, both east and west of

Pioneer Highway, and Church Creek Basin collects runoff from the fringes of Stanwood. The majority of Stanwood drains to Irvine Slough, including the downtown and most of the city west of 72nd Avenue NW (City of Stanwood 2005). The project will contribute runoff to six tributaries of the lower mainstem of the Stillaguamish River. The on-site stormwater runoff collection areas for the project are divided into 15 Threshold Discharge Areas (TDAs), based on the roadway design and existing drainage patterns (Figure 4). The TDAs for this project are numbered west to east, starting with TDA 1 at the west project boundary and ending with TDA 15 at the east project boundary (Appendix C).

Threshold Discharge Areas

- TDAs 1-5 discharge to Irvine Slough-WRIA 05.0014
- TDA 6 and TDA 7 discharge to Church Creek-WRIA 05.0018
- TDA 8 and TDA 9 discharge to Stream 4-WRIA 05.0020, an unnamed tributary to Church Creek.
- TDA 10, TDA 11, and TDA 12 discharge to Miller Creek-WRIA 05.0024 via a system of unnamed tributaries; Stream 9-WRIA 05.0023a and Stream 10-WRIA 05.0024a.
- TDA 13 discharges to Stream 12-WRIA 05.0061.
- TDA 14 and TDA 15 discharges to Stream 13-WRIA 05.0065.

Figure 3. SR 532: Locations of Threshold Discharge Areas 1-15

Proposed Drainage Configuration

Design Basis

The project corridor has 36.96 acres of existing untreated impervious surface and the project will result in a total of 5.23 acres of new impervious surface within the project area. A total of 4.56 acres of the new impervious surface will be treated, while 6.81 acres of existing impervious surface will be retrofitted for treatment and infiltration (Table 1). The 2008 average daily travel (ADT) of SR 532 in the project area is 18,000 ADT and will receive enhanced treatment. Stormwater facilities were designed in accordance with the WSDOT 2006 Highway Runoff Manual. TDAs 1 through 4 are located within the 100-year floodplain in Stanwood. The roadway through these TDAs run parallel to Irvine Slough, and during flood events temporary berms are placed on the roadway shoulder by the city of Stanwood to protect Stanwood from flooding. This makes the installation of permanent BMPs inadvisable within these TDAs.

Stormwater BMPs by TDA

TDA 1

Stormwater runoff along the north side of SR 532 sheet flows into vegetated ditches, through a culvert under SR 532 and into Irvine Slough. Along the south side of SR 532, stormwater sheet flows and is conveyed in vegetated ditches discharging directly into Irvine Slough or is conveyed through the city of Stanwood's storm drainage system and then discharges into Irvine Slough. Irvine Slough occurs within the 100-year floodplain of the Stillaguamish River, and is part of Stanwood's storm drain system. Irvine Slough flows parallel to SR 532 for about 1.5 miles and connects along the right bank of the Old Stillaguamish River Channel at river mile (RM) 1.4 through a tidal/gate pump station. This pump station is operated and maintained by the city of Stanwood. Impervious surface within TDA 1 will be reduced from pre-existing conditions for a total of 5,708 square feet due to the installation of planter strips and will not require additional treatment or flow control. TDAs 1-5 are exempt from flow control requirements due to the Department of Ecology's decision on exemption discharge to Irvine Slough. This exemption is based on stormwater treatment being provided by ecology embankments with a flat gradient to the discharge point that is controlled by tide gates and pumps (Nolan, pers. comm. 2007).

TDA 2

Stormwater runoff along the north side of SR 532 sheet flows into vegetated ditches, through a culvert under SR 532 and into Irvine Slough. Along the south side of SR 532, stormwater sheet flows and is conveyed in vegetated ditches discharging directly into Irvine Slough or is conveyed through the city of Stanwood's storm system and then discharges into Irvine Slough. New impervious surface within this TDA will total 25,867 square feet. Stormwater BMPs in TDA 2 have constructability issues because of their location within the 100-year floodplain. Because TDAs 1-5 all discharge into Irvine Slough, the lack of treatment in TDA 2 will be compensated by over treatment in TDA 5.

TDA 3

Stormwater runoff along the north side of SR 532 sheet flows into vegetated ditches, through a culvert under SR 532 and into Irvine Slough. Along the south side of SR 532, stormwater sheet flows and is conveyed in vegetated ditches discharging directly into Irvine Slough or is conveyed through the city of Stanwood's storm system and then discharges into Irvine Slough. There will be no new impervious surface created within this TDA; therefore, will not require additional flow control or treatment.

Table 1. Existing and Proposed Impervious Surface within the SR 532 Project Corridor TDAs

	THRESHOLD DISHARGE AREA (TDA)															*Total (acres)*
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
EXISITNG IMPERVIOUS (acres)																
PRE-PROJECT																
Existing treated impervious surface **with discharge** to waterbody	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*0.00*
Existing impervious surface **infiltrated**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*0.00*
Existing **untreated** impervious surface	2.10	3.42	1.93	1.77	3.48	3.43	2.75	0.96	6.01	2.17	2.00	0.20	3.40	2.00	3.51	*39.13*
Total existing impervious surface	2.10	3.42	1.93	1.77	3.48	3.43	2.75	0.96	6.01	2.17	2.00	0.20	3.40	2.00	3.51	*39.13*
POST-PROJECT																
Existing impervious surface **retrofitted** for treatment **with discharge** to waterbody	0.00	0.38	0.00	0.11	0.19	0.00	0.00	0.00	1.94	0.93	0.12	0.00	0.40	0.52	0.65	*5.24*
Existing impervious surface **retrofitted for infiltration**	0.00	0.62	0.00	0.18	0.31	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*1.71*
NEW IMPERVIOUS (acres)																
New treated impervious surface **with discharge** to waterbody	0.00	0.00	0.00	0.00	0.38	1.12	0.00	0.00	0.47	0.48	0.07	0.00	0.18	0.25	0.29	*3.24*
New impervious surface **infiltrated**	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	*0.61*
New **untreated** impervious surface	0.00	0.57	0.00	0.04	0.00	0.00	0.00	0.00	0.14	0.01	0.12	0.01	0.03	0.09	0.37	*1.38*
Total new impervious surface	0.00	0.57	0.00	0.04	0.99	1.12	0.00	0.00	0.61	0.49	0.19	0.01	0.21	0.34	0.66	*5.23*
TOTAL IMPERVIOUS (acres)																
Total impervious surface area **untreated** post-project	*2.10*	*2.99*	*1.93*	*1.52*	*2.98*	*2.83*	*2.75*	*0.96*	*4.21*	*1.25*	*2.00*	*0.21*	*3.03*	*1.57*	*3.23*	33.56
Total impervious surface area **treated** post-project with discharge to waterbody	*0.00*	*0.38*	*0.00*	*0.11*	*0.57*	*1.12*	*0.00*	*0.00*	*2.41*	*1.41*	*0.19*	*0.00*	*0.58*	*0.77*	*0.94*	8.48
Total impervious surface area **infiltrated**	*0.00*	*0.62*	*0.00*	*0.18*	*0.92*	*0.60*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	2.32

TDA 4

Stormwater runoff along the north side of SR 532 sheet flows into vegetated ditches, through a culvert under SR 532, and into Irvine Slough. Along the south side of SR 532, stormwater sheet flows and is conveyed in vegetated ditches discharging directly into Irvine Slough or is conveyed through the city of Stanwood's storm system and then discharges into Irvine Slough. New impervious surface will total 1,788 square feet and does not require treatment because it is under the 5,000 square feet threshold for required treatment (WSDOT 2006b).

TDA 5

Stormwater runoff along the north side of SR 532 sheet flows into vegetated ditches, through a culvert under SR 532 and into Irvine Slough. Along the south side of SR 532, stormwater sheet flows and is conveyed in vegetated ditches discharging directly into Irvine Slough or is conveyed through the city of Stanwood's storm system and then discharges into Irvine Slough. New impervious surface will total 39,095 square feet and will require additional treatment. The stormwater treatment for this TDA will provide over-treatment for TDA 2 and will include 3,984 feet ecology embankments located on south side of SR 532. Quarry spalls will be located at the point of discharge and provide outfall erosion protection.

TDA 6

The directional flow of stormwater runoff is west to east within TDA 6. Sheet flow runoff is conveyed through a vegetated ditch on the south side of SR 532 and is ultimately discharged into Church Creek. New impervious surface will total 21,090 square feet and will require additional flow control and treatment. The stormwater treatment for this TDA will include both flow control and enhanced water treatment with a combined stormwater wetland/detention pond in the NE quadrant of SR 532 and 72nd Ave NE intersection. The wetland/detention pond will be located within a portion of 268th St. NW that is to be decommissioned during the realignment. The wetland/detention pond will include an outfall structure and outfall protection and continue conveyance through a grass-lined ditch on the south side of 268th St. NW for approximately 0.10 miles to Church Creek.

TDA 7

The directional flow of stormwater runoff is east to west within TDA 7. Sheet flow runoff is conveyed west of 64th Ave NW along vegetated ditches and discharges to Church Creek. New impervious surface will total 177 square feet and will not require additional flow control or treatment.

TDA 8

The directional flow of stormwater runoff is east to west within TDA 8. Sheet flow runoff is conveyed along SR 532 through vegetated ditches to 64th Ave NE. Runoff continues south with conveyance through vegetated ditches and culverts (driveway crossings) for approximately 0.15 miles and discharges to an unnamed tributary to Church Creek (WRIA 05.0020). New impervious surface will total 140 square feet and will not require additional flow control or treatment.

TDA 9

The directional flow of stormwater runoff is west to east within TDA 9. Sheet flow runoff is conveyed along SR 532 through vegetated ditches and discharges to Stream-WRIA 05.0018c, unnamed tributary to Church Creek (WRIA 05.0018). In the areas of high roadway embankment and steep side slopes, eight catch basins collect roadway runoff and discharge runoff via single pipe segments at the toe of the side slopes. New impervious surface will total 26,151 square feet and will require additional treatment and flow control. The stormwater treatment and flow control for this TDA will include 3,500 feet of ecology embankments located on both sides of SR 532 and a water treatment/detention pond for flow control located on the south side of SR 532 near the western boundary of the TDA.

The majority of directional flow of stormwater runoff is east to west within TDA 10. Sheet flow runoff is conveyed along SR 532 through vegetated ditches and discharges to Stream-WRIA 05.0023a, an unnamed tributary to a drainage ditch-WRIA 05.0023 to Miller Creek. New impervious surface will total 21,425 square feet and will require additional treatment and flow control. The stormwater treatment for this TDA will include 2,000 feet of ecology embankments located on both sides of SR 532 and a detention vault for flow control located on the south side of SR 532 near the western boundary of the TDA.

TDA 11

The majority of directional flow of stormwater runoff is east to west within TDA 11. Sheet flow runoff is conveyed along SR 532 through vegetated ditches to 36th Ave NW. Runoff continues south with conveyance through vegetated ditches and culverts (driveway crossings) for approximately 0.19 miles and discharges to Miller Creek-WRIA 05.0024. New impervious surface will total 8,750 square feet and will require additional treatment and flow control. The stormwater treatment for this TDA will include 800 feet of ecology embankments located on both sides of SR 532 and a detention vault for flow control located on the south side of SR 532 and west of 36th Ave. NW.

TDA 12

The directional flow of stormwater runoff is east to west within TDA 12. Sheet flow runoff is conveyed along SR 532 through vegetated ditches to 36th Ave NW. Runoff continues south on 36th Ave NW with conveyance through vegetated ditches and an existing storm drain for approximately 0.19 miles and discharges to Miller Creek. There will be no new impervious surface created within this TDA; therefore, it will not require additional flow control or treatment.

TDA 13

The directional flow of stormwater runoff is both east to west and west to east within TDA 13. Sheet flow runoff is conveyed along SR 532 through vegetated ditches to W. Sunday Lake Rd. Runoff continues south with a discharge to Stream-WRIA 05.0061. New impervious surface will total 5,568 square feet and will require additional treatment and flow control. The stormwater treatment for this TDA will include 2,950 feet of ecology embankments located on the north side of SR 532 and a small wet pond for flow control located at the southeast quadrant of the W Sunday Lake Rd. and SR 532 intersection.

TDA 14

The directional flow of stormwater runoff is west to east within TDA 14. Sheet flow runoff is conveyed along SR 532 through vegetated ditches and discharges to Stream-WRIA 05.0065, an unnamed tributary to Pilchuck Creek. New impervious surface will total 14,652 square feet and will require additional treatment and flow control. The stormwater treatment for this TDA will include 2,950 feet of ecology embankments located on the north side of SR 532 and a small wet pond for flow control located on the south side of SR 532 near the eastern boundary of the TDA.

TDA 15

The directional flow of stormwater runoff is west to east within TDA 15. Sheet flow runoff is conveyed along SR 532 through vegetated ditches and discharges to Stream -WRIA 05.0065. New impervious surface will total 29,606 square feet and will require additional treatment and flow control. The stormwater treatment for this TDA will include 2,328 feet of ecology embankments located on the north sides of SR 532 and a water treatment/detention pond for flow control located in the northwest quadrant of the 12th Ave NW and SR 532 intersection.

STORMWATER POLLUTANT DISCHARGE AND MIXING ANALYSIS

According to the Snohomish County Surface Water Management Division (Thornburgh 2008 pers. com.), data for copper and zinc are not easily available from any Snohomish County watershed. Lacking data from the Stillaguamish River watershed, WSDOT looked to the nearest watershed of comparable size where data is available for a surrogate level of background pollutants.

Bear Creek (WRIA 08-0105; Middle Sammamish River HUC 171100120401) roughly approximates Church Creek in basin size, degree of development, and discharge, and can be used as a surrogate representation for copper and zinc background levels for Church Creek and other streams receiving stormwater from this project. King County (J. Frodge, pers comm. 2008) has provided average annual background levels of dissolved zinc (6.8µg/L) and dissolved copper (1.1µg/L) for Bear Creek collected at the confluence of the Sammamish River, and are considered most representative of the basin. Sublethal thresholds for salmonids have been identified as less than 2.0µg/L dissolved copper over background levels not exceeding 3.0µg/L, and 5.6µg/L dissolved zinc over background levels between 3.0 µg/L and 13.0. Assuming the data for Bear Creek is a reasonable surrogate for Church Creek and other streams receiving stormwater from this project, the sublethal thresholds are 4.1µg/L dissolved copper and 12.4µg/L dissolved zinc.

Stormwater runoff from TDAs 1-5 sheet flows into vegetated ditches and either directly or through culverts to Irvine Slough. The slough is demonstrated not to support protected species and any pollutant concentrations beyond background arising from the roadway would be indistinguishable at the pump station outlet.

Stormwater discharge will enter Church Creek from four TDAs in the project area. Of those TDA's, all will discharge treated stormwater into bioswales that are dry most of the year. TDA 6 stormwater will be treated and released to a vegetated swale 1,000 feet long before discharge to Church Creek. Stormwater from TDA 9 (TDA 7 and 8 will not receive treatment due to the de minimus amount of impervious surface) stormwater that is not infiltrated in the 3,500 feet of ecology embankments will sheet flow to vegetated ditches and discharge to Stream-WRIA 05.0018c, unnamed tributary to Church Creek.

Stormwater from TDAs 10, 11 and 12 which is not infiltrated or otherwise treated in ecology embankments will be conveyed to vegetated swales before discharge to Miller Creek or its tributaries.

TDA 13 will discharge to and mix insensibly with a minor Stillaguamish River tributary. This discharge will flow approximately three miles downstream, through two minor lakes, before being introduced to the Stillaguamish River (Figure 4).

Stormwater that does not enter the 5,278 feet of ecology embankment from TDAs 14 and 15 will sheet flow into vegetated swales and discharge to stream 05.0065 where the closest documented protected species is approximately 1.8 miles downstream at another unnamed tributary to Pilchuck Creek.

Dry Season Conditions

Precipitation records indicate that July and August are the lowest rainfall months and least likely for storm events that would exceed the capacity of the stormwater treatment BMPs and produce discharge to Church Creek or other project streams. During this dry period, the primary removals of pollutants not captured by the ecology embankments and other BMPs are the actively growing grasses and sedges of the bioswales. There is an average of nearly one storm per month in July and August and two storms per month in September that are greater than 0.5 inch in a 24-hour period, roughly four storms during the summer months that would cause discharge from the project roadway. During July, August, and September, discharge from all TDAs would almost always occur with significant flushing through the grassy swales. During these events, it is assumed that dissolved copper will not exceed 2.3 µg/L, and dissolved zinc will not exceed 5.6 µg/L in the stormwater discharge.

Wet Season Conditions

Pollutant-loading concentrations are difficult to assess when flow volumes are high in the Stillaguamish River, Church Creek, and other related systems. During the 6-month storm or larger, the grassy bioswales receiving stormwater are "activated" and the receiving water body can rapidly dilute stormwater contaminants. Moreover, the high frequency of the discharges will preclude elevated concentrations of contaminants from accumulating in stormwater. When the project TDAs discharge at high flow conditions, it is anticipated that dilution of dissolved copper and zinc concentrations would occur either at the end of the outfall pipe or within several feet of the pipe when the high flow condition is extended for periods of one day or more. The flushing action of the Stillaguamish River, Church Creek, and other tributaries would be substantial because the respective water body flows would be much greater than that of the outfall pipes.

Stormwater Summary

Collectively, and individually, stormwater effluent from the SR 532 project fifteen Threshold Discharge Areas will have an insignificant and discountable impact on protected species. The Stillaguamish basin encompasses approximately 720 square miles. The Church Creek and other project drainages are a relatively minor component of the Stillaguamish River basin and estimates of the total effective impervious surface within these sub basins is not easily available (Snohomish County, 2008 pers. com.). This project proposes to add 5.23 acres of pollution generating impervious surface, or 0.001% to the Stillaguamish River basin. Stormwater discharge from all TDAs is either infiltrated into ecology embankments or will sheet flow to extended grassy bioswales before being introduced to either the Church Creek or other Stillaguamish River tributary. In either case, substantial pollutant removals are expected by the biological uptake of plants in the swales. The USGS gauging station records show that the Stillaguamish River and Church Creek flows fluctuate greatly from November to June, indicating that regular mixing of stream and stormwater will occur. Except during the summer months, river and creek levels that coincide with stormwater discharge from the SR532 corridor BMPs will dilute discharged stormwater to sublethal thresholds of 4.1µg/L dissolved copper and 12.4µg/L dissolved zinc.

Church Creek, Pilchuck Creek, and stream 05.0065 are documented to support steelhead and there are no specific barriers to bull trout foraging. From July to October, stream flows remain more constant and at lower levels. Approximately four summer rainfall events that result in discharge from the stormwater systems are anticipated without a significant rise in the flow of the streams. In these cases, it is reasonable to assume discharges would be minimal as stormwater BMPs would be empty and would require a protracted rain event to initiate a flow. In those few instances of sufficient rainfall to cause flow into the swales, foraging bull trout or rearing juvenile steelhead would not likely be exposed to elevated concentrations of dissolved copper (above 4.1µg/L) and dissolved zinc (above 12.4µg/L) due to the removals by the grasses an sedges in the bioswales.

PROJECT VICINITY

Information compiled in the following sections was gathered through literature reviews, interviews with local biologists, and several site visits.

Project Setting and Land Use

The project area is located on SR 532, between I-5 and the east approach of the General Mark W. Clark Memorial Bridge which spans West Pass (Figure 1). SR 532 is a rural collector with existing daily traffic volumes varying from 16,000 to 26,000 and design year traffic is 2030. SR 532 is the only transportation corridor connecting Camano Island to the mainland. The project area incorporates the entire length of the city of Stanwood's Urban Growth Area.

Historically, agriculture dominated the lower Stillaguamish River Basin in the project vicinity. Today, land use consists of residential, industrial, agricultural, and public facilities. Development has increased in the surrounding landscape over the past fifteen years, including significant rural development in the unincorporated portion of the project area.

Drainage Basin

The project area is located within the lower mainstem of the Stillaguamish River Basin-WRIA 05.001. This lower mainstem portion includes 18 miles of river reach up to the confluence of the North and South forks in Arlington. At RM 2.75, the river splits into the Old Stillaguamish River Channel-WRIA 05.005 and Hat Slough-WRIA 05.0001. The Old Stillaguamish River Channel was the primary channel to Port Susan until a series of floods redirected flow to Hat Slough over 70 years ago (Ecology 2004). Hat Slough provides a direct pathway to Port Susan; the Old Stillaguamish River Channel meanders for eight miles until it splits in the South and West Pass. The Stillaguamish River, including the Old Stillaguamish River Channel is considered a Shoreline of the State within the project area (Washington Administrative Code [WAC] 173-18-350). The mainstem Stillaguamish River is listed on the 2004 303(d) list for temperature (Ecology 2005). The Stillaguamish River Basin supports a variety of resident and anadromous salmonids, including Chinook, steelhead, and bull trout, (WSCC 1999). The Stillaguamish River watershed has been divided into 27 sub-basins for management use by tribal, state, and local natural resources (WSCC 1999). Of the 27 sub-basins, nine are found within the mainstem. In-water work for the off-site mitigation will take place within Lower Pilchuck Creek sub-basin. The Pilchuck Creek sub-basin supports a variety of resident and anadromous salmonids, including Chinook and steelhead.

Streams

Sixteen streams were identified within the project corridor (Table 2). The ordinary high water mark was delineated and surveyed for all sixteen streams. Of the sixteen streams, nine were not mapped or typed by Washington Department of Natural Resources (WDNR). In these unmapped streams, WSDOT biologists typed the stream using best professional judgment through visual observations conducted during field visits. Fish presence/absence surveys were not conducted in any of the streams, so typing was conservative to ensure maximum buffer protection.

Anadromous salmonid use in identified streams is limited to Church Creek, Stream 13-WRIA 05.0065, and Pilchuck Creek at the off-site mitigation site. Anadromous salmonids are not documented in Irvine Slough (the discharge location for TDAs 1-5) because of a tide gate and pump station located at its confluence with the Old Stillaguamish River Channel. This report provides only detailed descriptions for Church Creek, Stream 13-WRIA 05.0065, and Pilchuck Creek-WRIA 05.0062 because they support anadromous salmonids. Irvine Slough has also been included in these descriptions because stormwater discharge from TDA 5 into Irvine Slough has a slight pollutant load increase and ultimately discharges to the Old Stillaguamish River Channel.

Church Creek-WRIA 05.0018

Church Creek is a major tributary of the Stillaguamish River. Its watershed drains approximately 11 square miles of agricultural, forested, and rural residential lands. The headwaters originate north of the SR 532 corridor in the plateau above the Stillaguamish River floodplain, within unincorporated Snohomish County. Church Creek flows south for 6.9 miles through a mixture of forested rural development and small farms until it becomes Jorgenson Slough at RM 1.01. From here, Jorgenson Slough flows west to confluence with the Old Stillaguamish River Channel at right bank RM 3.8. A tide gate is installed at the confluence with the Old Stillaguamish River Channel and is considered a complete barrier to Chinook salmon and a partial migration barrier to coho, steelhead, and cutthroat trout (City of Stanwood 2005). Snohomish County's Surface Water Management Division's (SWMD) biological sampling conducted in 1997 and 1999 found Church Creek to be in "fair" condition, as it pertains to water quality (SWMD 2000). The primary water quality problem in Church Creek is the high bacteria concentration. This appears to be caused by varied farming practices and failing septic systems (SWMD 2000).

Church Creek flows through an 8'x 6' 168-foot long concrete box culvert under SR 532 at MP 6.14. This culvert was previously retrofitted with three log weirs and one sackcrete weir downstream, with a series of rock weirs upstream for grade control and fish passage at the 268th Street NW culvert crossing. It remains on the WDFW/WSDOT barrier list as a partial barrier, because the upper-most log weir does not appear to provide sufficient backwater to meet WDFW fish passage depth standards and water surface drop on one or more of the weirs is in exceedence of the standard maximum of 0.8 feet (WDFW 2003). The project safety improvements will not require alteration of this culvert; therefore, a culvert fix or replacement is not required and not funded for this project. No in-water work will occur in Church Creek; however, TDA 6 and 7 will discharge into Church Creek through existing grass-lined ditches.

Table 2. Streams within the SR 532 Project Corridor

Stream Name/Number	WRIA	WDNR Stream Type*	Snohomish County Stream Type	Snohomish County Buffer (ft)	City of Stanwood Buffer (ft)	Project Reach Salmonid Use	Comments
Douglas Slough	05.0009	F			100	Unlikely	Lacks habitat, fish use likely limited by elevated water temp and insufficient dissolved oxygen
Irvine Slough	05.0014	F			100	Unlikely	Pump station is a barrier to anadromous fish
1	05.0014a	F (not mapped)*			100	Unlikely	Tributary to Irvine Slough
2	05.0018b	N (not mapped)*			75	None	Tributary to Church Creek
Church Creek	05.0018	F			100	Documented	Steelhead, coho, presumed bull trout
3	05.0018a	Ns (not mapped)*	Ns	50		None	
4	05.0020	N	N	50		None	
5	05.0020a	Ns (not mapped)*	Ns	50		None	
6	05.0020b	N	N	50		None	
7	05.0020c	Np (not mapped)*	Ns	50		None	
8	05.0020d	Np (not mapped)*	Np	50		None	
9	05.0023a	Np (not mapped)*	Np	50		None	
10	05.0024a	Np (not mapped)*	Np	50		None	
11	05.0061a	Np (not mapped)*	Np	50		None	
12	05.0061	N	N	50		Presumed	WDNR typed "N" below SR 532 crossing.
13	05.0065	F	F	150		Documented	Coho, Steelhead in the lower reach (east of I-5)

S=shoreline of the state; F=fish bearing; Np=non-fish perennial; Ns=non-fish seasonal

* Streams not mapped were typed during site visits using biologist's best professional judgment.

Stream 13-WRIA 05.0065

Stream 13-WRIA 05.0065 headwaters originate north of the SR 532 corridor from a large wetland complex located on a plateau above the Stillaguamish River floodplain, within unincorporated Snohomish County. The stream flows south/southeast 3.1 miles, crossing under SR 532 through a 203-foot long, 48-inch diameter culvert with less than one percent (0.67%) gradient at MP 9.75 to confluence with an unnamed tributary (WRIA 05.0064), where it continues to flow for 0.01 miles to confluence with Pilchuck Creek.

Pilchuck Creek-WRIA 05.0062

Pilchuck Creek is the largest tributary to the lower Stillaguamish River and drains approximately 75 square miles. The lower portion of Pilchuck Creek, includes 9.5 miles of mainstem and includes the portion of drainage from three miles above SR 9 north of Bryant, downstream to the confluence with Stillaguamish River, where it enters from the right bank at RM 9.5, northeast of Silvana. Pilchuck Creek is considered a Shoreline of the State within the project area (WAC 173-18-350. Pilchuck Creek is listed on the 2004 303(d) list for fecal coliform and temperature (Ecology 2005). The lower Pilchuck provides migration, spawning and rearing for anadromous species, with the lower six to seven miles being the major spawning grounds used by Chinook, coho, pink, steelhead, and chum salmon (WSCC 1999). Low summer flows cause stranding within the lower reaches and is a major limiting factor in salmon production (WSCC 1999). In-water work in Pilchuck Creek will be minimal and will only require removal of the barrier plug to connect the new off-channel habitat outlet at the mitigation site.

Irvine Slough-WRIA 05.0014

Irvine Slough appears to originate in the Stillaguamish River floodplain from a high water table, surface flows, and potentially from flows associated with Wetland 15. It flows east to west, along the south side of SR 532 for approximately 1.5 miles, from just east of the BNRR tracks at the east end of the floodplain, west to the Old Stillaguamish River Channel. The Irvine Slough connects along the right bank of the Old Stillaguamish River Channel at approximately RM 1.4 through a tidal gate/pump station that is operated by the city of Stanwood. The pump station level is maintained below the bottom of the flood gates, approximately two feet (City of Stanwood 2005). This pump station is a complete migration barrier to anadromous salmonids. WDNR has typed Irvine Slough as “F” (fish-bearing), based on the presence of resident species. Irvine Slough is listed on the final 2004 303(d) list for fecal coliform bacteria (Ecology 2005), and elevated summer temperatures and low dissolved oxygen levels also occur in the reach (Griffith, pers. comm. 2007). These conditions are expected to limit the productivity of this slough to support aquatic species. No in-water work will occur in Irvine Slough; however, TDAs 1-5 will discharge into Irvine Slough through existing outfalls.

Wetlands

The USFWS National Wetland Inventory identifies several small wetlands within the SR 532 project corridor, the majority of which are located outside WSDOT right-of-way (USFWS 1996). In 2007, WSDOT biologists identified and delineated 56 wetlands within the project area. A detailed study of the wetlands within the project corridor was prepared for this project (WSDOT 2008). Project construction will permanently impact 3.6 acres of freshwater wetlands and 5.8 acres of freshwater wetland buffer, as well as, temporary impacts to approximately 0.52 acres of freshwater wetlands. All wetland mitigation will occur off-site, but remain within the same sub-basin of some of the impact areas at the Pilchuck Creek mitigation site.

Geography and Soils

The project site is located within the wide, alluvial floodplain of the mainstem Stillaguamish River inset within terraces of glacial outwash. Permeability, drainage, and erosion hazard varies depending on the soil type.

The Snohomish County soil survey identifies nine soils series within the project area: Bellingham silty clay loam, Puget silty clay loam, Pastik silt loam, Tokul-Winston gravelly loam, Tokul gravelly loam, Lynnwood loamy sand, Everett gravelly sandy loam, and Winston gravelly loam (USDA, SCS 1978). The majority of the soil within the project corridor falls under the Bellingham, Puget, and Tokul series. The Bellingham series is a very deep, poorly drained soil in depressional areas on floodplains and are Hydrological Type D soil, while Puget and Tokul soils are Type C (USDA, NRCS 2004). Agriculture, urban and residential development has substantially modified local soils and altered their hydrological character.

Vegetation

Vegetation in the project vicinity is mixed forest, agricultural fields, and planted landscape in urban and rural areas. Forested species typically include western hemlock *(Tsuga heterophylla)*, western red cedar *(Thuja plicata)*, Douglas-fir *(Pseudotsuga menziesii)*, big leaf maple (*Acer macrophyllum*), black cottonwood (*Populus balsamifera*), and red alder (*Alnus rubra*). The forested understory typically includes vine maple (*Acer circinatum*), salmonberry (*Rubus spectabilis*), Indian plum *(Oemleria cerasiformis)*, snowberry (*Symphoricarpos albus*), thimbleberry *(Rubus parviflorus)*, sword fern *(Polystichum munitum),* bracken fern *(Pteridium aquilinum)*, and lady fern *(Athyrium felix-femina)*.

Agricultural fields support native shrub and grass species such as Douglas spiraea *(Spiraea douglasii),* nutka rose *(Rosa nutkana),* fescue (*Festuca spp.),* bentgrass *(Agrostis spp.)*,and non-native species including Himalayan blackberry *(Rubus armeniacus)*, reed canarygrass *(Phalaris arundinacea)*, perennial ryegrass *(Lolium perenne)*,and orchardgrass *(Dactylis glomerata)*.

STUDIES AND COORDINATION

Biologists gathered information for the BA by visiting the project site, reviewing the proposed action, corresponding with area experts, and reviewing best available science.

The biologist reviewed the following materials:

- Design plans (Appendix B).
- Stormwater analysis (Appendix D).
- Habitat information provided by ARC Map (WDNR 2007, WDFW 2008a, WDFW 2008b, WDFW 2008c)
- Life history information for listed species (Appendix E).
- Site visits, topographic maps, and photos of the action area.
- Scientific reports regarding species present in the action area.
- Discussions with local tribes, WDFW, and other experts knowledgeable of the area.
- Pre-BA meeting with USFWS and NMFS.

ACTION AREA

The Federal Register defines the action area for a project as all areas to be affected directly and indirectly by the federal action, and not merely the immediate action area involved in the action (50 CFR 17.11). For the SR 532 project corridor, it includes both terrestrial and aquatic habitats.

For terrestrial habitat, the action area includes a one-half mile radius around the project corridor and the proposed off-site mitigation site to account for the anticipated increase in noise above baseline levels during construction (Figure 5 and 6). Noise will attenuate to background levels within this distance. ESA terrestrial species are not expected within the defined action area.

For aquatic habitats, a 200-foot action area has been defined on the basis of water quality standards and mixing zone distances established by the Implementing Agreement between the Washington Department of Ecology (DOE) and WSDOT for Surface Water Quality Standards (WSDOT and Ecology 1998). Stream flow measured at the Pilchuck Creek mitigation site calculated a mean of 15.9 cfs for the month of August 2007 (Ecology 2007). This stream flow falls well within the 10 cfs to 100 cfs parameter which requires a 200-foot mixing zone. Stream flows are variable for the 16 (mapped and unmapped) streams (Table 2) located within the project corridor and are expected to have flows less than Pilchuck Creek during the time of construction, because of this, a 200-foot action area has been designated for all streams.

In-water work will include the creation of off-channel habitat on Pilchuck Creek within the Stillaguamish Tribe mitigation site (Figure 6). Design is currently in the conceptual phase, but off-channel habitat construction will incorporate an old drainage ditch that was excavated to originally drain the property and adjacent wetlands. Flow from Pilchuck Creek will be isolated from the new off-channel habitat during construction and possibly after completion for a short period to allow plant establishment and settlement of the substrate. The temporary barrier will be removed during the fish work window and during low flows to minimize turbidity increases. Given the expectation of plant establishment, the first flush of water through the newly installed off-channel habitat is not likely to disturb sediments or create turbidity downstream.

Other in-water work proposed for this project will include the realignment of two unmapped non-fish bearing streams, Stream 2-WRIA 05-0018b and Stream 8-WRIA 05.0020d during new road alignment and construction of a climbing lane. Stream 2-WRIA 05-018b will result in 88 linear feet of impacts due to the relocation of the stream in a culvert under the new 268th Street NW realignment. Loss of stream habitat will be mitigated for on site. There will be no loss in linear stream habitat for Stream 8-WRIA 05.0020d and neither streams are expected to have a required fish work window.

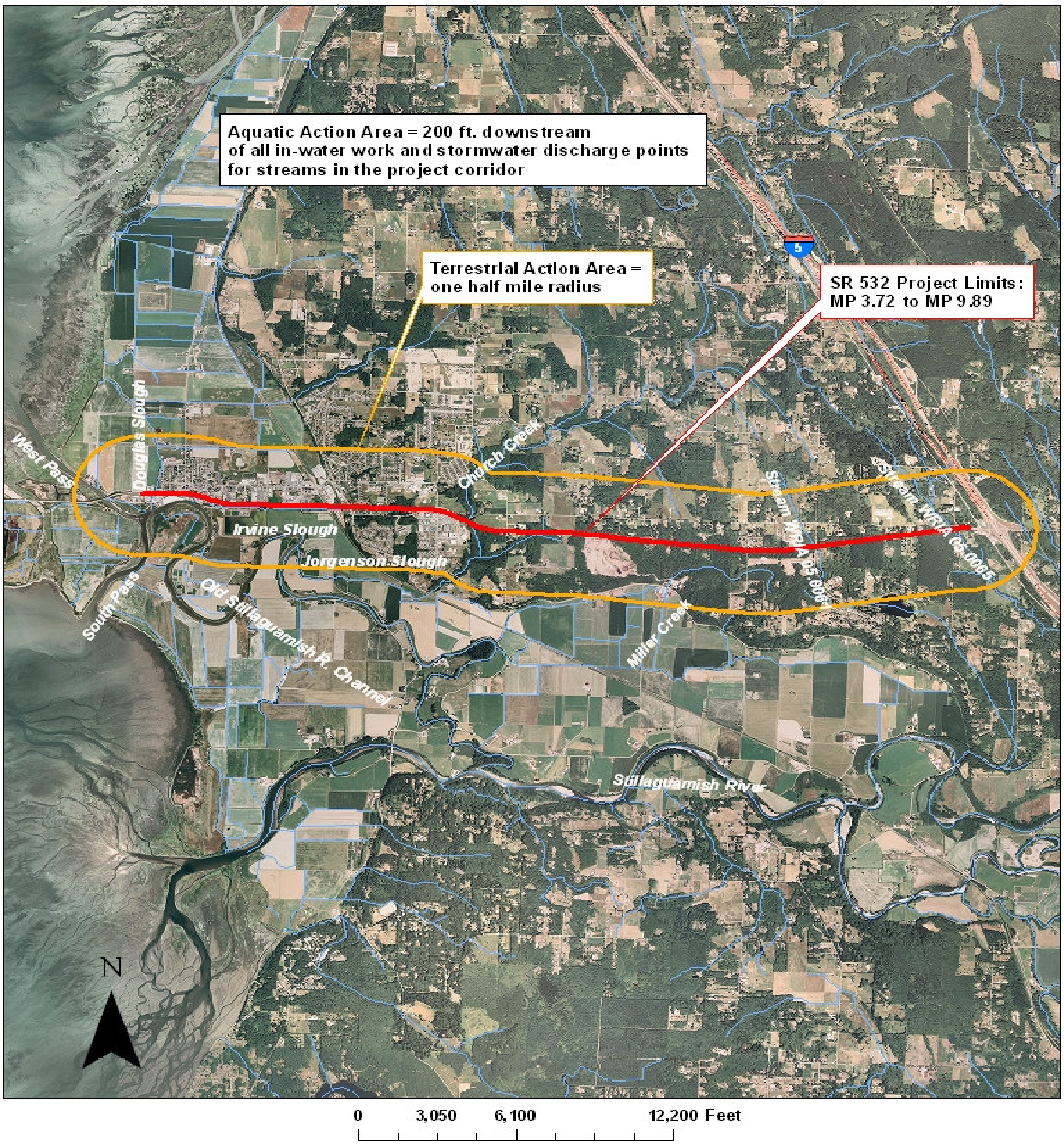

Figure 4. SR 532 Project Action Area

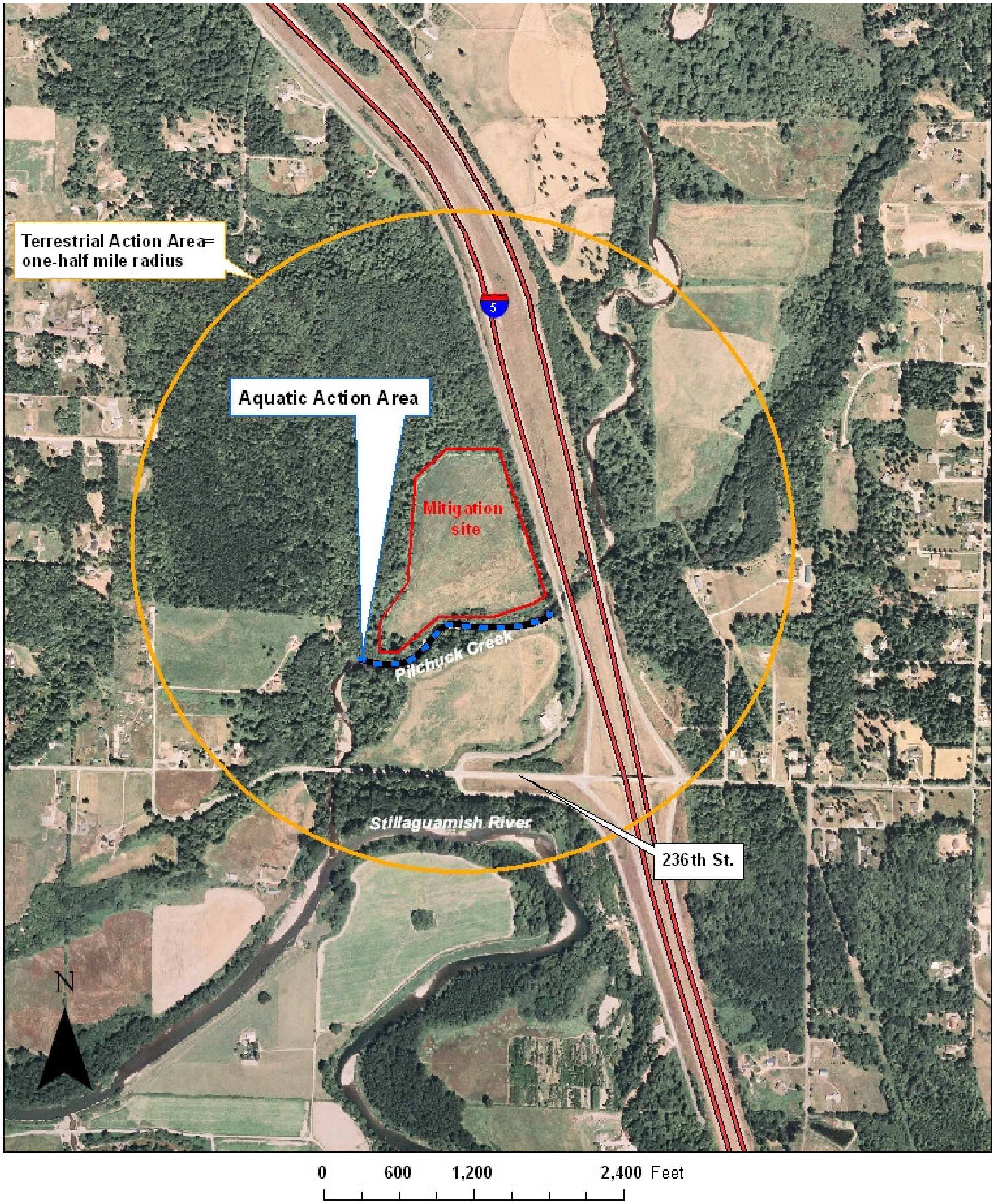

Figure 5. Disjoint Action Area for the Mitigation Site Located on Pilchuck Creek

LIST OF SPECIES AND HABITAT

NMFS and USFWS indicate that listed species and designated critical habitat may be present in Snohomish County. Site-specific information indicates that at least three of these listed species have the potential to occur in the project vicinity (NMFS 2007, USFWS 2007, WDFW 2008, WDNR 2007). Other listed species that occur in Snohomish County do not have suitable habitat or documented occurrences within the Action Area. The WDNR Natural Heritage Program does not list any threatened or endangered plants within the Action Area (WDNR 2007).

Threatened Species

- Puget Sound/ Costal DPS bull trout *(Salvelinus confluentus)*
- Puget Sound ESU Chinook salmon *(Oncorhynchus tshawytscha)*
- Puget Sound DPS steelhead trout *(O. mykiss)*

Designated Critical Habitat

- Puget Sound/ Costal DPS bull trout
- Puget Sound ESU Chinook salmon
- Critical habitat has not been proposed for steelhead trout.

Bull Trout

WDFW (2004) has identified four local populations of bull trout in the Stillaguamish Watershed: the North Fork Stillaguamish River (including Boulder Creek and potentially Squire Creek); the South Fork Stillaguamish River; Canyon Creek; and Upper Deer Creek (SIRC 2005). Anadromous, fluvial and resident fish all exist in the Stillaguamish River watershed and overlap geographically. Because of this overlap and the lack of fish movement data, all bull trout/Dolly Varden in the Stillaguamish River Basin are considered to be a single stock (WDFW 2004). The stock status and spawn timing is unknown for the Stillaguamish stock (Table 3).

Site Specific

Due to life history and habitat requirements (Appendix E), the existing water quality suggests that bull trout do not spawn in streams within the project corridor. There is no known documentation of bull trout using tributaries found within the project action area, but it is presumed that Church Creek and Pilchuck Creek may support foraging opportunities within the project action area (WDFW 2008). In addition, Stream 13-WRIA 05.0065 supports coho, a known prey species; therefore, it has the potential to support foraging bull trout. Severe limiting factors related to low summer flows, high stream temperatures, and low dissolved oxygen make presence of bull trout highly unlikely in any of the tributaries within the action area. The Stillaguamish River, including the Old Stillaguamish River Channel is designated bull trout critical habitat (USFWS 2005). However, none of the streams within the action area are designated critical habitat for bull trout.

Chinook Salmon

Chinook salmon spawn in the mainstem, North Fork and South Fork of the Stillaguamish River, as well as several of the larger tributaries (Pilchuck, Jim, Canyon, Squire, French, Deer, and Boulder Creeks). Two populations of Chinook salmon are found in the Stillaguamish Basin: North Fork (Summer) Chinook and South Fork (Fall) Chinook, with the predominant population being the North Fork summer run (WSCC 1999). Juvenile Chinook rear throughout the river system with approximately 98-99% being of ocean-type and rearing for one to five months in freshwater habitat before migrating out (Table 3) (WSCC 1999). Though somewhat dated for population trend analysis, thee Salmonid Stock Inventory lists the 2002 status for North Fork Stillaguamish Chinook and South Fork Stillaguamish Chinook salmon as depressed primarily due to low stock productivity (WDFW 2002).

Site Specific

A small population of fall Chinook can be found in Pilchuck Creek with the majority of spawning located between the I-5 and SR 9 reach just upstream of the mitigation site (Griffith, pers.comm. 2008). Chinook are not documented in any of the other tributaries to the Stillaguamish in the project action area. Chinook presence in any life stage within these tributaries is highly unlikely due to low summer flows, high stream temperatures, and lack of suitable habitat. Pilchuck Creek and the Stillaguamish River, including the Old Stillaguamish River Channel are designated Chinook salmon critical habitat (NMFS 2005).

Steelhead

Four steelhead stocks have been identified in the Stillaguamish watershed, including one winter run and three summer runs. Stillaguamish winter steelhead were identified based on their distinct spawning distribution with spawning taking place in the mainstem Stillaguamish, the north and south forks of the Stillaguamish, Pilchuck, Creek, Jim Creek, and Canyon Creek and its tributaries (Table 3) (WDFW 2002). Though somewhat dated, the 2002 stock status is listed as depressed because of a long-term negative trend and severe short-term decline in recent index escapement counts (WDFW 2002). The three summer runs are made up of three distinct stocks: Deer Creek, the South Fork Stillaguamish, and Canyon Creek. The Deer Creek summer stock was identified based on their distinct spawning distribution, with the majority of spawning taking place in the upper Deer Creek drainage. The stock status was rated as depressed in 2002 because of chronically low juvenile densities (WDFW 2002). The South Fork Stillaguamish summer stock was identified based on their distinct spawning distribution, with the majority of spawning taking place in the South Fork Stillaguamish upstream from Granite Falls (WDFW 2002). The 2002 South Fork Stillaguamish stock status is unknown. The Canyon Creek summer stock was identified based on their distinct spawning distribution, with spawning taking place in Canyon Creek and its forks (WDFW 2002). The 2002 Canyon Creek stock status is unknown.

Site Specific

Winter steelhead are documented in three streams within the action area: Church Creek, Pilchuck Creek, and Stream 13-WRIA 05.0065. Both adult and juvenile steelhead are documented using Church Creek within the action area (Peter Verhey, pers. comm. 2008). Pilchuck Creek is used for spawning, with the majority of spawning taking place upstream of the Stanwood Bryant Rd. bridge crossing (approximately RM 2.7), approximately 2.7 miles upstream of the wetland mitigation construction area (WDFW SalmonScape 2008). In Stream 13-WRIA 05.0065, steelhead are documented in the lower reach of this stream near the confluence with unnamed tributary –WRIA 05.0064 and Pilchuck Creek approximately 1.8 miles downstream of the SR 532 culvert crossing (WDFW SalmonScape 2008). In 2000, WSDOT retrofitted the northbound I-5 culvert for Stream 13-WRIA 05.0065. However, steelhead are not documented in Stream 13-WRIA 05.0065 west of the I-5 crossing.

Table 3. General Timing of Life Stages of Salmonids in the Stillaguamish Watershed (modified from WSCC 1999)

Chinook Salmon	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Upstream Migration	□□□	□□□	□□□	□□□	□□□	□■■	■■■	■■■	■■■	■□□	□□□	□□□
Spawning	□□□	□□□	□□□	□□□	□□□	□□□	□□□	□■■	■■■	■■■	□□□	□□□
Juvenile Rearing	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Outmigration	□□□	□□□	□■■	■■■	■■■	■■■	□□□	□□□	□□□	□□□	□□□	□□□

Bull Trout	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Upstream Migration					u n k	n o w	n					
Spawning					u n k	n o w	n					
Juvenile Rearing					u n k	n o w	n					
Outmigration					u n k	n o w	n					

Winter-Run Steelhead	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Upstream Migration	■■■	■■■	■■■	■■■	□□□	□□□	□□□	□□□	□□□	□□□	■■■	■■■
Spawning	□□□	□□□	■■■	■■■	■■■	■■□	□□□	□□□	□□□	□□□	□□□	□□□
Juvenile Rearing	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Outmigration	□□□	□□□	□□□	■■■	■■■	■■■	□□□	□□□	□□□	□□□	□□□	□□□

Summer-Run Steelhead	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Upstream Migration	□□□	□□□	□□□	□□■	■■■	■■■	■■■	■■■	■■■	■■□	□□□	□□□
Spawning	□□□	□□■	■■■	■■■	■■■	□□□	□□□	□□□	□□□	□□□	□□□	□□□
Juvenile Rearing	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Outmigration	□□□	□□□	□□□	■■■	■■■	■■■	□□□	□□□	□□□	□□□	□□□	□□□

ENVIRONMENTAL BASELINE

USFWS and NMFS provide a matrix of pathways and indicators to assist in defining the baseline habitat for listed fish species (Table 5). The best available scientific information about the environmental baseline in lower mainstem Stillaguamish River comes from personal communication with WDFW and tribal biologists, WSDOT biologists during site visits, and habitat information from WRIA 05 Salmon Limiting Factors Report (WSCC 1999). The analysis applies to potential impacts the project may have on water quality, habitat access, habitat elements, channel conditions and dynamics in the project action area and on a watershed scale. For the purpose of the assessment, the lower mainstem Stillaguamish River and its tributaries were considered for the watershed scale.

Sub-population Characteristics

The following indicators are specific to bull trout and were only examined at the watershed scale.

Sub-population Size

Sub-population characteristics are a baseline parameter established by the USFWS for bull trout. Three streams within the action area (Church Creek, Stream 13-WRIA 05.0065, and Pilchuck Creek) support habitat for salmonids, which are prey species for bull trout. These streams contribute to potential bull trout foraging, refuge, and juvenile rearing habitat. The extent of the bull trout population in the Stillaguamish watershed is unknown and is based on random observations rather than quantitative studies. There has been no systematic survey of bull trout in the Stillaguamish watershed (WSCC 1999).

For this reason, the environmental baseline is rated *at risk* for this species regarding population size, growth/survival, life history diversity, and genetic integrity in the Stillaguamish watershed and action area. The project will *maintain* all sub-population baseline parameters in the action area and on a watershed scale.

Growth/Survival

The growth and survival of any population of bull trout potentially using the lower Stillaguamish watershed habitat is *unknown*. Habitat degradation is a major factor affecting production, with agriculture and residential development contributing to poor water quality in the lower river (WDFW 2004). Because of this, anadromous adult and sub-adult migration holding habitat in the mainstem Stillaguamish River and low river sloughs suffer from summer low flows and high temperatures (WDFW 2004).

The proposed project will *maintain* the baseline conditions. The size of the project relative to the watershed and its location within the landscape (encompassing areas that naturally limit bull trout presence because of low flows and temperature), and the lack of habitat alteration would not put any existing population at risk.

Table 4. USFWS and NOAAF Matrix of Habitat Pathways and Indicators

DIAGNOSTICS	ENVIRONMENTAL BASELINE CONDITIONS			EFFECTS ON THE ACTION AREA			EFFECTS ON THE WATERSHED			NOTES
PATHWAYS AND INDICATORS	Functioning Appropriate	At Risk	Functioning Unacceptable	Restore	Maintain	Degrade	Restore	Maintain	Degrade	
Sub-population Characteristics										
Subpopulation Size		X			X			X		The Stillaguamish River supports four local populations of bull trout. The action area also supports habitat for prey species.
Growth/Survival		X			X			X		
Life History Diversity/ Isolation		X			X			X		
Persistence and Genetic Integrity		X			X			X		
Water Quality										
Temperature			X		X			X		
Sediment		X			X			X		
Chemical Contaminants. /Nutrients			X		X			X		
Habitat Access										
Physical Barriers			X		X			X		This project will *maintain* fish passage in the Stillaguamish watershed.
Habitat Elements										
Substrate		X			X			X		
Large Woody Debris		X			X			X		
Pool Frequency/Quality		X			X			X		
Off-channel Habitat		X		X				X		The mitigation site will create off-channel habitat for Pilchuck Creek; therefore the project will help to *restore* off-channel within the Action Area.
Refugia		X		X				X		The mitigation site will create refugia for Pilchuck Creek; therefore the project will help to *restore* refugia within the Action Area.
Channel Condition and Dynamics										
Width:Depth Ratio		X			X			X		
Streambank Condition		X			X			X		
Floodplain Connectivity			X		X			X		

Table 4 (cont'd): USFWS and NOAA Fisheries Matrix of Habitat Pathways and Indicators

DIAGNOSTICS	ENVIRONMENTAL BASELINE CONDITIONS			EFFECTS ON THE ACTION AREA			EFFECTS ON THE WATERSHED			NOTES
PATHWAYS AND INDICATORS	Functioning Appropriate	At Risk	Functioning Unacceptable	Restore	Maintain	Degrade	Restore	Maintain	Degrade	
Flow Hydrology										
Peak/ Base Flows		X			X			X		
Drainage Network Increase		X			X			X		
Watershed Conditions										
Road Density and Location		X			X			X		
Disturbance Regime		X			X			X		
Riparian Reserves		X			X			X		
Integration of Species and Habitat Conditions	**unknown**				X			X		

Life History Diversity/Isolation

Anadromous, fluvial, and resident life history forms are all found in the Stillaguamish watershed and, in some cases, overlap geographically. Because this overlap and lack of fish movement data within the basin, all bull trout/Dolly Varden in the Stillaguamish Basin are considered to be a single stock (WDFW 2004).

No permanent riparian or in-stream habitat will be lost as part of this project. The addition of impervious surface as part of the project will not alter stream flow regimens and enhanced stormwater runoff treatment will maintain or improve stream water quality. Therefore, the project will *maintain* baseline conditions.

Persistence & Genetic Integrity

There is insufficient quantitative data to assess the status of the Stillaguamish stock. However, with exception of the Deer Creek drainage, the stock appears to be stable, or expanding, based on limited spawner surveys of Boulder Creek and the upper Stillaguamish (WDFW 2004).

The proposed project will *maintain* the baseline conditions because the project work does not include any riparian or in-stream habitat alteration that would further fragment bull trout populations.

Water Quality

Temperature

Within the Stillaguamish watershed, water temperatures are a significant water quality problem. Human-caused increases in stream temperature are believed to be directly influenced by the removal of streamside vegetation and by channel widening (WSCC 1999). A stream temperature study conducted by the Stillaguamish Tribe, Tulalip Tribe, and Snohomish County in 1996 showed temperatures in the mainstem and select tributaries were in stressful ranges during a large percentage of the time (WSCC 1999). The mainstem Stillaguamish River and Pilchuck Creek are listed on the 2004 Ecology 303(d) list for temperature (Ecology 2005)

This habitat indicator is *functioning unacceptable* within the watershed and *at risk* within the project action area. The proposed project will remove upland vegetation and will add impervious surface, but will replant disturbed areas with native vegetation and will provide stormwater treatment in accordance with the WSDOT Highway Runoff Manual (2006b). The benefits of this mitigation are not anticipated to be discernable from existing conditions, so the project is anticipated to *maintain* existing baseline conditions at both the watershed and action area scale.

Sediment

Sediment is considered one of the two most prevalent non-point source pollutants in the Stillaguamish watershed, with the main contributions being forest practices, agricultural practices development, and urban runoff (WSCC 1999). In the lower mainstem Stillaguamish and tributaries, agriculture, development, and urban runoff are the more significant contributors.

Based on the matrix of pathways and indicators criteria, baseline conditions for sediment are *at risk* on a watershed level, and action area. Project construction will unlikely impact salmonids, as WSDOT will install BMPs before construction begins that will help prevent sediment from reaching area streams and wetlands. Roadway runoff will be treated and total suspended solids will be removed from stormwater. This treatment is expected to decrease or maintain levels of TSS from stormwater runoff reaching discharge streams within the action area. However, this improvement will not likely be discernible from existing levels, so the project will *maintain* baseline conditions for this parameter at the watershed scale.

Chemical Contamination/Nutrients

Non-point source pollution is a major cause of water quality pollution in the Stillaguamish River. Non-point source pollution can come from any dispersed land-based or water-based activity, with the following four being the most significant non-point source pollutants: agricultural practices, on-site sewage disposal, development and urban runoff, and forest practices (SWMD 2000). Since 1994, the Washington Department of Ecology has been measuring metals six times a year in the Stillaguamish River. Concentrations of mercury and copper have been found in excess of state criteria during this monitoring program (WSCC 1999). High fecal coliform is also a problem in the mainstem, with the main contributors being commercial and non-commercial farms and leaking or inadequate septic systems (SWMD 2000). Fecal coliform is generally associated with high concentrations of nutrients (nitrate and phosphorus), which, these can generate algal blooms capable of causing decreased dissolved oxygen levels in the mainstem. Pilchuck Creek is listed on the 2004 303(d) list for fecal coliform (Ecology 2005).

Baseline conditions for chemical contaminants and nutrients are *functioning unacceptable* within the watershed and functioning *at risk* in the action area. The stormwater treatment for the project is expected to decrease levels or maintain a net zero increase of metals and chemical contaminants from stormwater runoff reaching tributaries of the Stillaguamish River. Project construction and operation of the project facilities, including stormwater treatment systems are expected to *maintain* baseline conditions on both the watershed and action area scales because any improvements or degradations to water quality from project construction and stormwater treatment will be discountable at both scales.

Habitat Access

Habitat access includes the presence of culverts, bridges, or other physical in-water obstructions that might impede fish migration.

Physical Barriers

Fish passage obstructions in stream channels severely limit fish populations by restricting their spatial distribution and limiting spawning and rearing populations from upstream habitats. Tide gates limiting fish passage are located in two of the tributaries (Irvine Slough and Jorgenson Slough/Church Creek) within the action area. At least four fish barrier culverts under SR 532 have been identified as requiring repair by WSDOT and WDFW for streams that drain to the Stillaguamish and its tributaries (WDFW and WSDOT 2007). For this reason, physical barriers are *functioning unacceptable* on a watershed scale and action area. This project will *maintain* baseline conditions for this parameter at both the watershed and action area scale.

Habitat Elements

Habitat elements to potentially support stream use by over-wintering or pioneering Chinook salmon and bull trout include substrate, large woody debris (LWD), pool frequency and quality, and off-channel habitat.

Substrate

Substrate types vary within the project corridor tributaries. In the floodplain tributaries and sloughs, the substrate is typically consists of silt and sand with pockets of small gravel. In the relief area tributaries, substrate is comprised of sand, gravel, and cobbles. Embeddedness percentages are unknown, but land uses within the watershed are likely to contribute to higher percentages.

For these reasons, baseline conditions for sediment are *at risk* at both the watershed and action area scales. The proposed project is not anticipated to degrade baseline conditions. BMPs will be installed to protect areas downstream from sedimentation and substrate embeddedness and fines will be captured in stormwater facilities. Planned stormwater treatment is expected to decrease levels or have a net zero increase of TSS from stormwater runoff reaching streams within the action area. The project is expected to *maintain* baseline conditions for this parameter at both the watershed and action area level because this improvement will not likely be discernible from existing levels.

Large Woody Debris

Throughout the Stillaguamish River Basin, agriculture, logging, and development have removed large coniferous trees from the riparian zones. Within the project corridor, the Church Creek, Stanwood City, and Stillaguamish Floodplain sub-basins have more than 90 percent riparian degradation (WSCC 1999). This loss of riparian vegetation has led to the loss of LWD recruitment into streams. Reach-level habitat data for stream channel throughout the Stillaguamish Basin counted an average of 15 pieces of wood per 100 meters (WSCC 1999). The average and maximum number of pieces of wood per 100 meters in agricultural streams is 70% less than what is found in forested and rural residential lands (WSCC 1999).

This habitat indicator is *at risk* within the watershed and project action area because of the lack of LWD and channel complexity that has been substantially diminished in many reaches within the lower mainstem basin. The proposed project will restore impacted riparian areas with native vegetation and in-water work includes the installation of LWD. Therefore, the project will help *restore* LWD in the action area and will *maintain* the status of this indicator at the watershed scale.

Pool Frequency and Quality

The loss of pool area is associated with removal and reduction of LWD, increases in sediment, and increase in peak flows. Pool spacing correlates with the number of wood pieces per meter in both rural and forested areas adjacent to stream channels that have (<0.01) and moderate (>0.01 and >0.04) slopes (Snohomish County 1999). According to the Snohomish County Public Works Surface Management Division (SWMD) Stillaguamish River survey, pool percent area for the lower Stillaguamish was 46.4 percent and was within the "At Risk" (degraded) criteria range developed by NMFS (1996) (SWMD 2002). Pool frequency was calculated at 2.7 pool per km and fell within "Not properly functioning" criteria range developed by the Stillaguamish Technical Advisory Group (STAG) (2002) (SWMD 2002).

This habitat indicator is *at risk* within the watershed and project action area because of the lack of LWD and channel complexity that has been substantially diminished in many reaches within the lower mainstem basin. The proposed project will restore impacted riparian areas with native vegetation, and in-water work includes the installation of LWD for pool habitat enhancement. Therefore, the project will *maintain* the status of this indicator at both the watershed and action scale.

Off-channel Habitat

Almost 70 percent of the off-channel rearing habitat in the mainstem has been lost due to the construction of levees and revetments, and the removal of gravel and LWD. Beaver ponds, sloughs, and tidelands account for the majority of this habitat loss (Snohomish County 1999).

This habitat indicator is *at risk* within the watershed and project action area because of the lack of LWD and channel complexity that has been substantially diminished in many reaches within the lower mainstem basin. The proposed project will create off-channel habitat at the Pilchuck mitigation site. Therefore, the project will *restore* the status of this indicator at the action area scale and *maintain* on the watershed level.

Refugia

Refugia by definition are high quality habitats of appropriate temperature, which may include pool habitat. Wetlands provide several functions that directly affect salmonids, with refugia being one of them. The loss of riverine wetlands and beaver ponds due to agriculture and residential development has declined the amount of refugia habitat within the Stillaguamish Basin.

The baseline conditions are functioning *at risk* within the watershed and action area. The proposed project includes the construction of off-channel habitat and wetland creation at the Pilchuck Creek mitigation site. This includes riparian plantings to increase shading, resulting in cooler temperatures in the action area over the long term. The project will improve the function of riparian areas and pool development; therefore, the project will *maintain* refugia on the watershed scale and *restore* the existing baseline conditions within the action area.

Channel Conditions and Dynamics

Habitat parameters to access channel conditions include width to depth ratio, streambank condition, and floodplain connectivity.

Width to Depth Ratio

Width to depth ratio data for the lower mainstem Stillaguamish are not readily available. In general, there appears to be a wide variety of width to depth conditions represented within the watershed because of the topography and variation in level of disturbance. The more developed drainages within the watershed have been destabilized by adjacent land use such agricultural, commercial, and residential development.

Based on this, the width to depth indicator appears to be *at risk* at both the watershed and action area scales. Stormwater flow control structures will be constructed to retain current flow regimens and avoid increasing bank erosion or channel scour; therefore, the proposed project will *maintain* current width to depth ratios at both the watershed and action area scales.

Streambank Condition

Streambanks in the watershed have undergone severe modifications from human disturbances that have displaced natural features and functions. The removal of 35-40 percent of the historical forest cover and 15-20 percent within the riparian area has helped contribute to greater amounts of streambank erosion (SIRC 2005). According to the Snohomish County Public Works Surface Management Division Stillaguamish River bank and habitat conditions survey, streambank stability within the lower Stillaguamish were relatively stable, but were over 50 percent modified (SWMD 2002).

Baseline conditions functioning *at risk* at both the watershed and action area scales. Project activities are not expected to impact bank stabilization. Given the hydrological conditions in the lower Stillaguamish basin, and the proposed stormwater facilities, WSDOT calculates that the project will not affect the creek's hydrological regimes. Therefore, the proposed project is expected to *maintain* streambank functions at both scales.

Floodplain Connectivity

A large portion of the Stillaguamish floodplain has been converted to agricultural and urban uses. Beaver ponds, side channels, and sloughs once used by salmon have been disconnected from the main river channel as a result of diking, bank revetments, and other agricultural practices (WSCC 1999). Currently, almost 58 percent of the Stillaguamish floodplain is in agricultural use reducing the storage and conveyance of flood waters (Snohomish County 2007).

The baseline indicators for floodplain connectivity are *functioning unacceptable* at the watershed scale and are functioning *at risk* in the project action area. The proposed project will fill in portions of wetlands located in the Stillaguamish 100-year floodplain, but will not impact any of the stream floodways. Although the project will slightly decrease flood capacity, the areas of floodplain that will be filled are considered isolated by existing highway and other transportation infrastructure. The project is anticipated to *maintain* the baseline conditions for floodplain connectivity at both the watershed and action area scales.

Flow/Hydrology

Analysis of flow and hydrology includes individual analyses of peak/base flows and the drainage network.

Peak/Base Flows

Peak flows are often recorded in late autumn and winter, typically from rain-on-snow events. More than one-third of the Stillaguamish Basin is located in the rain-on-snow area. The Stillaguamish watershed may be particularly sensitive to peak flows because much of the watershed is relatively low in elevation and, thus, more subject to these types of events (WSCC 1999).

Peak and base flows are functioning *at risk* in the Stillaguamish Basin and in the project action area. Given the hydrological conditions in the lower mainstem Stillaguamish, and the proposed stormwater facilities, WSDOT calculates that the project will not affect any of the stream's hydrological regimes in the action area. Therefore, the project will *maintain* the environmental baseline at the watershed and project action area scales.

Drainage Network

The Stillaguamish basin and action area have experienced significant increases in the drainage network density due to road construction and development, although the lower stream reaches in the alluvial floodplain have a much greater increase than higher in the watershed. Post-project conditions will include new detention and treatment facilities, but will use existing conveyance systems and discharge outlets.

This baseline indicator is likely *at risk* at the watershed and the action area scale because of the density and the total impervious surface estimated in the basin and action area. While the project will add impervious surface and will enhance the drainage system, the project will increase the amount of impervious surface in the watershed and project action area. These increases are considered negligible because it will have a drainage pattern that maintains stormwater within the sub-basin where it is collected. In addition, infiltration will be used to promote groundwater regeneration. Therefore, the project will *maintain* the status of this indicator at both the watershed and action area scales.

Watershed Conditions

Analysis of the watershed condition relies on individual analyses of the disturbance regime, riparian reserves, and the integration of species and habitat conditions.

Road Density/Location

Forest road density is an important indicator of watershed health. Forested areas with over two miles of road per square mile may not have properly functioning sediment and water delivery to lower section of the watershed (SIRC 2005). In general, the Stillaguamish Basin and action area have a moderate to high quantity of valley bottom roads.

The existing baseline conditions are functioning *at risk* for both the watershed and action area levels. The proposed project will install multiple turn lanes, truck climbing lanes, and will realign 268^{th} away from SR $532/72^{nd}$. New roadway features will create a negligible amount of new roadway, considering the amount already existing in the action area and the watershed. Overall, the project will *maintain* these baseline conditions at both the watershed and action area scales.

Disturbance History

The Stillaguamish watershed and action area have undergone moderate to high levels of disturbance from past agricultural development, and past and present residential and commercial development. The portion Church Creek sub-basin within the action area has experienced a large loss of functioning wetland area. The commercial and rural development that has occurred in this area prevents it from ever being restored (WSCC 1999). Therefore, this baseline condition is functioning *at risk* for both the watershed and action area scales. The project will *maintain* this baseline condition at both the watershed and action area scales.

Riparian Reserves/Conservation Areas

In different portions of the watershed, riparian areas have been moderately to drastically disturbed. In the project action area, agricultural practices and transportation features, such as SR 532, have fragmented stream riparian areas. At the watershed scale, natural vegetative communities have been lost to land clearing for agriculture and development. The widths of existing riparian buffers have been reduced and lack complexity and large trees.

Overall, this baseline condition is *at risk* at the watershed and action area scales. The proposed project will not permanently impact any streams or riparian buffers. Therefore, the project will *maintain* the status of this indicator at both scales.

Disturbance Regime

The disturbance regime indicator is specific to bull trout. The natural disturbance regimes have been drastically modified in the lower watershed by the channelization and armoring of the mainstem. Natural processes are generally unstable, and the lower watershed especially is frequently subjected to unpredictable flows, scour events, and flooding. Sediment transport and in-stream habitat elements have been altered and limited by past disturbance.

This baseline condition at the watershed and action area scales is *at risk,* but the project will *maintain* its status because stormwater BMPs will minimize impacts to stream flows.

Species and Habitat

Integration of Species and Habitat Conditions

This indicator is specific to bull trout. Agriculture and rural and urban development have caused habitat fragmentation in the Stillaguamish Basin. A large number of culverts and bridges have been placed at private and public road crossings of the Stillaguamish River and its many tributaries throughout the basin. In many reaches in the watershed and action area, development encroaches upon streams, riparian wetlands, and the floodplain. Base flows have likely been impacted by increased withdrawal for wells and loss of groundwater recharge from development. However, because the size of the bull trout population is unknown, the integration of species (bull trout) and habitat conditions is also *unknown* according to USFWS criteria.

The proposed project will *maintain* the integration of species and habitat conditions. No riparian or in-stream habitat will be lost by the construction of this project.

IMPACT AVOIDANCE AND MINIMIZATION

WSDOT will implement multiple avoidance and minimization measures throughout project design, construction, and operation in order to protect listed species and their habitat. These measures comprise design alterations that avoid sensitive area impacts, stormwater site plan (SSP), TESC plan, and site-specific BMP implementation.

Avoidance

Best Management Practices

BMP measures include erosion and sediment control, structural erosion control, sediment retention, water quality/quantity, and stormwater treatment during project construction and operation. These BMPs will be included in the TESC plan, SPCC plan, SSP, and stormwater report for the project. However, since BMPs are dynamic, actual site conditions may require additional measures or use other methods, as necessary, in the field. Changes to pre-approved BMPs will be approved by the WSDOT Project Engineer before being implemented.

Temporary Erosion and Sediment Control Plan

The Contractor must submit a Containment System Plan and submit or adopt a TESC plan before beginning any work on site. WSDOT must approve the plan and the Contractor implement it before work begins. The plan shall include erosion control and sediment containment methods used to prevent sediments and sediment-laden water resulting from road construction activities from reaching any area streams or wetlands. The Containment System Plan and the TESC Plan shall also include specific BMPs addressing potential spills at staging areas.

Protecting and Maintaining Existing Vegetation

WSDOT will protect riparian, wetland, and shoreline vegetation in the construction area wherever possible from disturbance. Protections include avoiding vegetation impacts by surveying clearing limit boundaries, then marking and fencing them with high visibility and silt fencing.

Minimization

Design Alterations

Project designers reduced the project footprint by shortening the length of the proposed westbound SR 532 truck climbing lane. This design change resulted in the reduction of wetland

and wetland buffer impacts. Other wetland, stream, and buffer impacts were avoided by constructing retaining walls near sensitive areas. Site restoration, stream buffer enhancement plantings, and wetland mitigation will recreate and eventually enhance all sensitive area riparian functions. WSDOT will minimize temporal impacts by constructing mitigation in the summer of 2008, before project work begins.

CONSERVATION MEASURES

Conservation measures were added to the project to avoid and minimize impacts to listed and proposed aquatic species (Page ii). Conservation measures include the following:

1. The project work will occur below the OHWM of Pilchuck Creek between July 1 and September 30 or in accordance with the work window established by the WDFW Hydraulic Project Approval.
2. If additional staging areas are proposed outside of the original project footprint, the sites will be reviewed by a WSDOT biologist to evaluate potential impacts to sensitive areas and listed species.

ANALYSIS OF EFFECTS

The proposed projects will not impact listed plants or terrestrial species because they, or their habitat, are not present in the action area or project vicinity.

The project has minimal potential to directly and indirectly impact listed aquatic species due to the low likelihood that they would be present in the action area during construction because of the work window and the installation of construction BMPs. The project will restore several fish habitat parameters that are a part of the environmental baseline, resulting in habitat improvements that may potentially benefit steelhead.

In the unlikely event that Chinook salmon or bull trout were present during construction at the mitigation site, the project incorporates a work window and BMPs to avoid and minimize impacts to aquatic species. For these reasons, any direct, indirect, and beneficial impacts to salmonid habitat are considered discountable to both Chinook salmon and bull trout.

Steelhead may be present in the Pilchuck Creek mitigation site action area; however, WSDOT anticipates that impacts to fish in the stream will be avoided or minimized during construction with the use of the fish window and temporary construction BMPs.

Direct Effects

Salmonid Species and Habitat

The direct effects of the project include potential impacts to listed aquatic species from vegetation clearing in riparian buffer area, stormwater runoff from new impervious surfaces, placement of fill below the OHWM, and streambed grading below the OHWM. Construction will unavoidably permanently impact approximately 8.89 acres of sensitive areas, including stream buffer (0.29 ac.), wetland buffers (5.8 ac), and wetlands (2.8 ac). Permanent stream buffer impacts will be limited to the Stream 2-WRIA 05.0018b channel realignment. Installing BMPs before any earthwork begins will prevent harmful materials from reaching any sensitive areas and/or entering storm drains connected to streams within the action area.

WSDOT will replicate all impacted habitat functions, reducing these impacts to small, discountable, short-term events and, with time, improve habitat functions beyond existing conditions. In addition, WSDOT is mitigating wetland and wetland buffer impacts in advance at a site within 2.4 miles of the construction occurring adjacent to Pilchuck Creek. Wetland mitigation includes construction and enhancement of riparian wetlands which are also stream buffers, as well as the creation of off-channel habitat to Pilchuck Creek. Pilchuck Creek flows adjacent to the site so stream buffer enhancement includes plantings such as native shrubs and conifers.

Stormwater

The project will add approximately 5.23 acres of new impervious surface to the lower mainstem Stillaguamish drainage; however, permanent stormwater BMPs will treat and infiltrate or store the water and likely improve the water quality baseline given that no stormwater runoff is currently treated in the project area. TDAs 11 and 15 are the only TDAs expected to have slight increases in annual effluent load for both dissolved zinc and dissolved copper (Appendix D). TDA 11 discharges to Miller Creek via an unnamed tributary that does not support listed species or habitat. TDA 15 discharges into Stream 13-WRIA 05.0065 and does not support listed species within the action area. Stormwater treatment will result in a reduction or net zero gain for expected pollutant concentrations for total suspended solids, total zinc, dissolved zinc, total copper, and dissolved copper for TDAs 1-15 (Appendix D). Given the stormwater treatment BMPs, discharge locations, and planting efforts associated with the project; no measurable impacts to bull trout, steelhead, and Chinook salmon habitat are anticipated as a result of new impervious surfaces

Indirect Effects

Salmonid Species and Habitat

An indirect effect is defined as one that is caused by the proposed action and that occur at a distance or after the action is complete. Sediment flow downstream of in-water work will be discountable to listed species, because steelhead, Chinook salmon, and bull trout are highly unlikely to be present. Sediment redistribution will be insignificant to any listed fish species present in the lower reaches. During construction at the Pilchuck Creek mitigation site, flow from Pilchuck Creek will be isolated from the new off-channel habitat during construction. The temporary barrier will be removed during the approved fish work window. During the first flush of water through the newly installed off-channel habitat, sediment may be disturbed and create turbidity downstream. Turbidity is not expected to be distinguishable above background conditions below the mixing zone point of compliance determined by Department of Ecology (WSDOT and Ecology 1998).

The project will improve water quality on the project level scale by providing enhanced treatment and flow control. This treatment will reduce metal, sediment, and toxicant levels reaching the streams within the project corridor. Flow control structures will alter water releases at discharge points; therefore, reducing the potential of scour in any of the streams present in the project corridor.

This conclusion is based on the baseline conditions in the watershed and the effectiveness of the proposed BMPs. The environmental baseline for sediment is at risk at the watershed and action area scales. The environmental baseline for chemical contamination and nutrients within the watershed is functioning unacceptable, with the action area at risk.

Induced Growth

The multiple variables affecting land development and the lack of a consistent and predictable transportation influence model, makes it difficult to analyze the indirect project-related effects for induced land development. However, WSDOT believes this project will not induce new, unplanned growth since the goal is not to increase traffic, but to redistribute existing traffic. During the document review for this project, WSDOT found no plans that depend upon this project as a development requirement, development permits contingent upon project construction, or project dependent zoning changes. Rather, the proposed project is a response to current traffic congestion and safety within the project corridor.

Beneficial Effects

Stormwater treatment and flow control is expected to benefit the water quality of stormwater discharge to streams within the project corridor. Off-site mitigation will create riverine wetland, off-channel, and refuge habitat.

Interdependent and Interrelated Actions

Interdependent actions of the project include the development of temporary staging areas and post-construction roadside restoration.

Temporary staging areas will be established on existing paved or gravel roads. If project construction requires moving staging areas, any newly established staging areas will be located in developed, upland areas such as existing gravel roads, parking lots, and roadway shoulders. Where existing landscape and topography limit the project staging areas, they will be temporarily located on upland areas. No equipment or material staging will occur in any sensitive areas or their functional buffers. All sensitive areas will be protected by appropriate BMPs such as silt fences, compost berms, storm drain inserts, etc. Therefore, establishment of staging areas will not affect listed salmonid species.

Temporarily disturbed upland areas in the project corridor will be revegetated in accordance with the Roadside Manual (WSDOT 2003) and the Roadside Classification Plan (WSDOT 1996). This restoration is not expected to have any effect on listed species. Earth disturbance during replanting will be contained and will not cause sediment to enter any streams or wetlands. These areas will already be isolated from undisturbed sensitive areas by appropriate construction TESC BMPs. These BMPs will remain in place until construction activities, including planting, are completed and will then be removed.

Wetland and stream buffer impacts will be minimal and require compensation mitigation. Riparian impacts will be minimized and restored on-site with native vegetation. Interrelated actions will also include the proposed off-site Pilchuck Creek mitigation area. Design will include wetland creation, wetland enhancement, riparian enhancement, and off-channel habitat creation.

EFFECT DETERMINATIONS

The effects determination for salmonids is based upon the conservation and performance measures integrated into this project.

Bull Trout

Bull trout may occur in Church Creek, and there are no specific blockages for entry into Stream 13-WRIA 05.0065 and Pilchuck Creek; however, bull trout have not been documented in any of sixteen streams in the project corridor. There are no potential direct effects to bull trout from project components. Potential indirect impacts comprise of discharging treated stormwater to Irvine Slough, Church Creek, and Stream 13-WRIA 05.0065. No bull trout mortality or measurable degradation of habitat is expected because of this project. This project **may affect, but is not likely to adversely affect** bull trout adults or juveniles.

A "**may affect**" determination is warranted based on the following rationale:

- There are no restrictions to bull trout usage of Church Creek or Pilchuck Creek.
- The project will add 5.23 acres of effective impervious surface, potentially reducing groundwater recharge and increasing peak flows in area streams.
- Treated stormwater will be discharged to Irvine Slough and Church Creek.

A "**may affect, not likely to adversely affect**" determination is warranted for this proposed project for bull trout because:

- Bull trout have not been documented in any of the project action area streams.
- Most environmental baseline conditions do not meet the criteria for suitable bull trout spawning and rearing habitat.
- The occurrence of bull trout in Church Creek or Pilchuck Creek is considered discountable except possibly as rare, occasional, incidentals foraging on coho salmon runs.
- Implementing project TESC plan BMPs will protect streams by keeping eroded sediments outside of their channels.
- In-water work will be conducted when flows are at their lowest during the approved WDFW fish window, July 1 to September 30.
- Post-project stormwater generated from all new and portions of existing effective impervious surface will be treated for water quality resulting in a reduction or net zero gain for overall pollutant concentrations before discharging to streams within the action area.
- New stormwater discharges from treatment facilities into streams will maintain current stream flows.
- Stream buffer restoration and wetland mitigation will restore and enhance habitat functions.

Chinook Salmon

Chinook salmon inhabit Pilchuck Creek; however, there are no potential direct effects to Chinook salmon from project components. Potential indirect impacts associated with the project arise from discharge of treated stormwater to streams within TDAs 1-15. No Chinook mortality or measurable degradation of habitat is expected because of this project. This project **may affect, but is not likely to adversely affect** Chinook salmon adults or juveniles.

A "**may affect**" determination is warranted based on the following rationale:

- Chinook salmon inhabit Pilchuck Creek and may occasionally spawn in the mitigation site action area.

- The project will add 5.23 acres of effective impervious surface, potentially reducing groundwater recharge and increasing peak flows in area streams.
- Treated stormwater will be discharged to streams within TDAs 1-15.
- The project will impact stream buffer, riparian wetland, and riparian wetland buffer areas.

A "**may affect, not likely to adversely affect**" determination is warranted for Chinook salmon because:

- Chinook have not been documented in any of the streams in the project corridor action area.
- In-water work at the Pilchuck Creek mitigation site will be conducted when flows are at their lowest during the approved WDFW fish window, July 1 to September 30.
- Implementing the project TESC plan and specified BMPs will protect streams and prevent eroded sediments from entering any stream.
- Post-project stormwater generated from all new and portions of existing effective impervious surface will be treated for water quality resulting in a reduction or net zero gain for overall pollutant concentrations before discharging to streams within the action area.
- Stormwater discharges from treatment facilities into streams will maintain current flows.
- Stream buffer restoration and wetland mitigation will restore and enhance habitat functions.

Steelhead Trout

Steelhead inhabit Church Creek and Pilchuck Creek. There are no potential direct effects to steelhead from project components. Potential indirect impacts associated with the project arise from discharge of treated stormwater to Church Creek. No steelhead mortality or measurable degradation of habitat is expected as a result of this project. This project **may affect, but is not likely to adversely affect** steelhead adults or juveniles.

A "**may affect**" determination is warranted based on the following rationale:

- Steelhead inhabit Church Creek and Pilchuck Creek and may occasionally spawn in the mitigation site (Pilchuck Creek) action area.
- The project will add 5.23 acres of effective impervious surface, potentially reducing groundwater recharge and increasing peak flows in area streams.
- Treated stormwater will be discharged to streams within TDAs 1-15, which may contain unknown concentrations of contaminants.
- The project will impact stream buffer, riparian wetland, and riparian wetland buffer areas.

A "**may affect, not likely to adversely affect**" determination is warranted for steelhead because:

- Implementing BMPs as specified in the project TESC plan will protect streams and prevent eroded sediments from entering any stream.
- Post-project stormwater generated from all new and portions of existing effective impervious surface will be treated for water quality resulting in a reduction or net zero

gain for overall pollutant concentrations before discharging to streams within the action area.

- Stormwater discharges from treatment facilities into streams will maintain current flows.
- Stream buffer restoration and wetland mitigation will restore and enhance habitat functions (Some areas will be recreated offsite to restore hydrological and, habitat functions).

CRITICAL HABITAT

Final designations of critical habitat for Chinook salmon and bull trout include the Stillaguamish River and Pilchuck Creek. The nearest critical habitat for bull trout is located in the Old Stillaguamish River Channel approximately 250 feet south of SR 532. There is no proposed in-water work or direct stormwater discharge to the mainstem or Old Stillaguamish River Channel. All stormwater will be treated and discharged to tributaries that are not designated critical habitat; therefore, the project will have **no effect** on critical habitat for bull trout. The nearest critical habitat for Puget Sound Chinook salmon includes the Old Stillaguamish River Channel and Pilchuck Creek located at the mitigation site. Three Primary Constituent Elements (PCE's) of critical habitat including fresh water spawning sites, freshwater rearing sites, and freshwater migration corridors are present in Pilchuck Creek. The project will not impact the PCE's based on the following information:

Sediment and turbidity may flow into the Pilchuck Creek following construction; however, turbidity will be greatly avoided and minimized with BMPs, in-stream gravel, and riparian plantings in the project area.

Work below the OHWM is limited to the construction of a new off-channel backwater outlet. There will be no impacts to spawning sites, freshwater rearing sites, or migration corridors.

For these reasons, the project will have **no effect** on designated critical habitat for Chinook salmon.

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APPENDIX A: ESSENTIAL FISH HABITAT

The U.S. Senate passed the Magnuson-Stevens Fishery Conservation and Management Act (MSA) in 1976 and reauthorized it in 1996. It currently protects Essential Fish Habitat (EFH), defined as "those waters and substrate necessary to fish for spawning, breeding, or growth to maturity".

The MSA includes a mandate that the NMFS must identify EFH for federally managed marine fish, and federal agencies must consult with NMFS on all activities that may adversely affect EFH. The Pacific Fisheries Management Council (PFMC) has designated EFH for the Pacific Salmon Fishery. The Pacific salmon management plan includes Chinook, coho, and pink salmon.

The EFH designation for the Pacific Salmon Fishery includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Washington, Oregon, Idaho, and California, except above the impassible barriers identified by PFMC (1999). The estuarine and marine areas, proposed EFH for salmon extends from near shore and tidal submerged environments within state territorial waters out to the extent of the exclusive economic zone offshore of Washington, Oregon, and California north of the Point of Conception (PFMC 1999). EFH does not include tribal lands and areas above specific dams or longstanding, naturally impassable barriers.

Church Creek, Stream13-WRIA 05.0065, and Pilchuck Creek all provide habitat for coho salmon. Pilchuck Creek supports coho, Chinook and pink salmon. For these reasons, these streams are considered EFH and part of the Pacific Salmon Fishery.

Effects on EFH

The project will **not adversely affect** EFH given the proposed Conservation Measures and habitat creation and restoration. Sediment and turbidity will be greatly avoided and minimized with the use of a work window, BMPs, and riparian plantings. In addition, proposed mitigation at the Pilchuck Creek mitigation site will include the construction of off-channel habitat, riparian enhancement, and wetland creation, resulting in beneficial effects for EFH. At the Pilchuck Creek mitigation site, the potential for sediment and turbidity would be less of a concern for pink salmon because the project would be constructed in an even year (2008) and pinks return to spawn in Pilchuck Creek in odd-numbered years only. Therefore, pink salmon will not be present during project construction

Life histories of EFH species

Coho salmon (Oncorhynchus kisutch) life history

Coho salmon are an ESA listed species of concern; therefore, the ESA does not require legal protection for this species. The Magnuson Stevens Act includes coho salmon in the Pacific Salmon Fishery Management Unit for Essential Fish Habitat. Coho salmon in the Stillaguamish watershed has two distinct stocks: Stillaguamish and Deer Creek. The Stillaguamish River stock is considered a mixture of native and non-native fish because of hatchery release from the early 1950s to 1981 (WSCC 1999). SaSI classifies this stock as depressed. The Deer Creek stock is native and status is unknown (WDFW 2002)

Coho salmon are native to many of the drainages in the Pacific Rim from California to Alaska, and west to Japan, and are found in most streams in the Puget Sound drainage (Wydoski & Whitney 1979). They are found in a broader diversity of habitats than any other anadromous salmonid. Much like the cutthroat trout (*Oncorhynchus clarki*), coho manage to survive in the most unlikely of surroundings (urban/suburban ditch lines, chemically-impacted farmland creeks, etc.). Although they have a relatively high threshold to habitat degradation, their numbers continue to decline. This may be an indication that human-caused impacts are greater than this species' resiliency (Wydoski & Whitney 1979).

In Washington, adult coho return from the ocean as early as August. Spawning occurs between October and early February. Depending upon temperature, eggs incubate in the gravel from three to four months. Coho fry emerge between February and June, and usually congregate in schools in the pools of a stream (Wydoski & Whitney 1979). The juvenile salmon generally rear in freshwater for the next 12-24 months. From May to June of their second year (occasionally their first), coho smolts migrate to the ocean. By fall, after just a few months of feeding in the marine environment, they have more than tripled their size (up to 20 inches long). While most coho will remain in the ocean for one more year, some males return to their natal streams in their first year to spawn as "jacks." Coho will begin their upstream migration as early as August to begin the cycle again (Meehan 1991).

Pink salmon

Pink salmon in the Stillaguamish watershed are geographically and temporally separated into two stocks, North Fork and South Fork. The genetic distinctions between two stocks are unknown (SIRC 2005). Pink salmon mature in two years, which means that odd-year and even-year populations are essentially unrelated. Frequently, in a particular stream, either the odd-year or even-year cycle will predominate, although in some streams, both odd- and even-year pink salmon are about equally abundant. Occasionally, cycle dominance will shift and the previously weak cycle will become most abundant. Pink salmon are listed by SaSI as healthy (WDFW 2002). Although the status has been rated as healthy in the basin, a biological review team from NMFS is concerned about a consistent decline in their body size. This trend may have a negative impact on reproductive potential and the species' ability to respond to environmental changes (WSCC 1999). Pink salmon enter the Stillaguamish on odd-numbered years from early August through Early October. They are found in the river on even-numbered years, but numbers are low. Spawning begins in late August and peaks in mid-October in the North and South Fork and larger tributaries (especially, Squire, Boulder, Jim, and Pilchuck) (WSCC 1999).

The ranges of Alaska pink salmon at sea and pink salmon from Asia, British Columbia, and Washington overlap each other. Different races or runs with differing spawning times frequently occur in adjacent streams or even within the same stream (ADFG 2005). Most pink salmon spawn within a few miles of the coast and spawning within the intertidal zone or the mouth of streams is very common. Shallow riffles where flowing water breaks over coarse gravel or cobble-size rock and the downstream ends of pools are favored spawning areas. The female pink salmon carries 1,500 to 2,000 eggs, depending on her size. She digs a nest, or redd, with her tail and releases the eggs into the nest. They are immediately fertilized by one or more males and then covered by further digging action of the female. The process is commonly repeated several times until all the female's eggs have been released. After spawning, both males and females soon die, usually within two weeks.

Sometime during early to mid-winter, eggs hatch. The alevins, or young fry, feed on the attached yolk sac material continuing to grow and develop. In late winter or spring, the fry swim up out of the gravel and migrate downstream into salt water. The emergence and outmigration of fry is heaviest during hours of darkness and usually lasts for several weeks before all the fry have emerged.

Following entry into salt water, the juvenile pink salmon move along the beaches in dense schools near the surface, feeding on plankton, larval fishes, and occasional insects. Predation is heavy on the very small, newly emerged fry, but growth is rapid. By fall, at an age of about 1 year, the juvenile pink salmon are 4 to 6 inches long and are moving into the ocean feeding grounds in the Gulf of Alaska and Aleutian Islands. High seas tag-and-recapture experiments have revealed that pink salmon originating from specific coastal areas have characteristic distributions at sea which are overlapping, nonrandom, and nearly identical from year to year.

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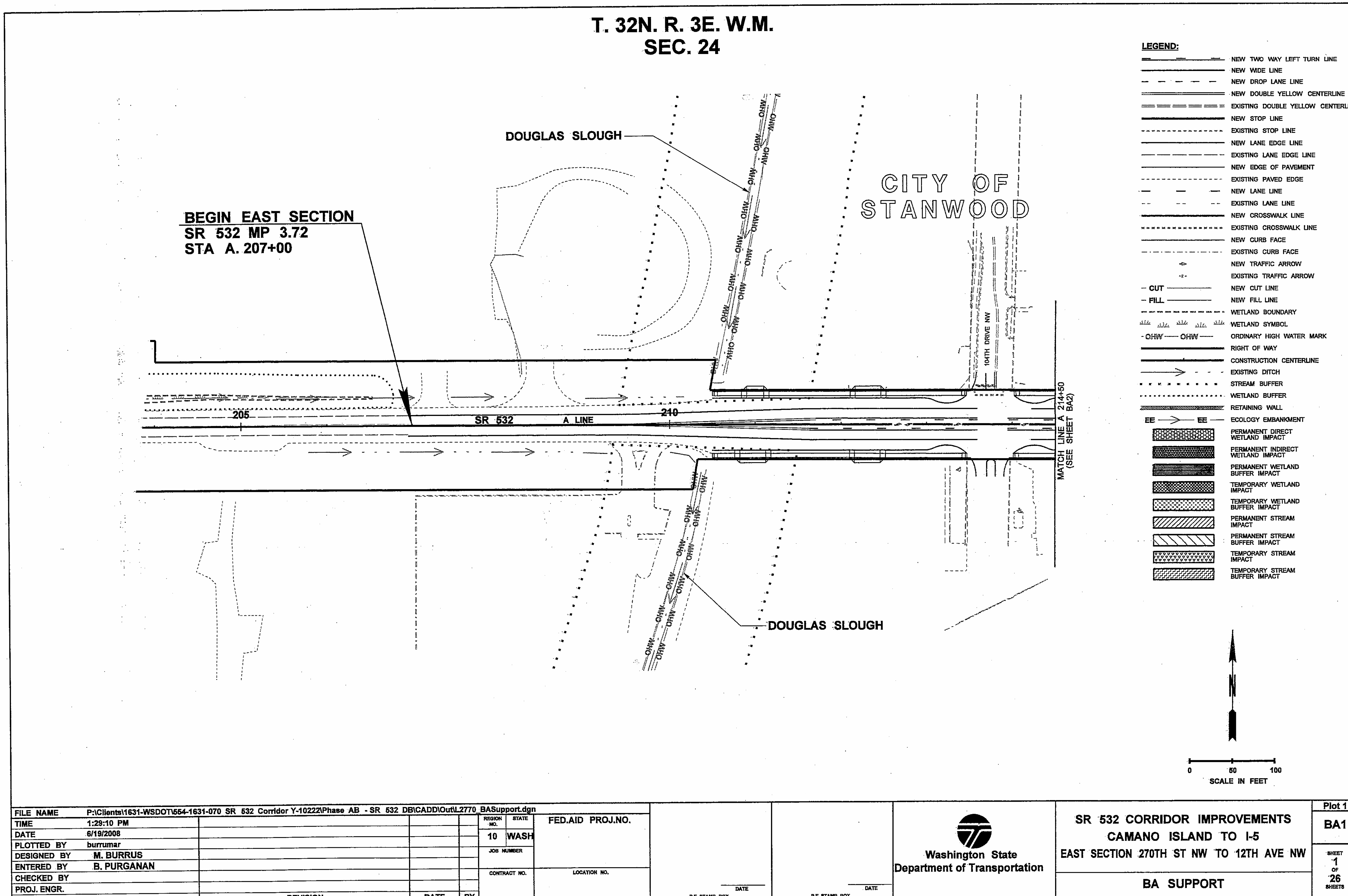
APPENDIX B: SR 532 DESIGN PLAN SHEETS



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SR 532
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NEW WIDE LINE
NEW DROP LANE LINE
NEW DOUBLE YELLOW CENTERLINE
EXISTING DOUBLE YELLOW CENTERLINE
NEW STOP LINE
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EXISTING PAVED EDGE
NEW LANE LINE
EXISTING LANE LINE
NEW CROSSWALK LINE
EXISTING CROSSWALK LINE
NEW CURB FACE
EXISTING CURB FACE
NEW TRAFFIC ARROW
EXISTING TRAFFIC ARROW
CUT
NEW CUT LINE
FILL
NEW FILL LINE
WETLAND BOUNDARY
WETLAND SYMBOL
OHW OHW
ORDINARY HIGH WATER MARK
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CONSTRUCTION CENTERLINE
EXISTING DITCH
STREAM BUFFER
WETLAND BUFFER
RETAINING WALL
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ENTERED BY B. PURGANAN
CHECKED BY
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REVISION
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BY
REGION NO. 10
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FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO.
LOCATION NO.
P.E. STAMP BOX
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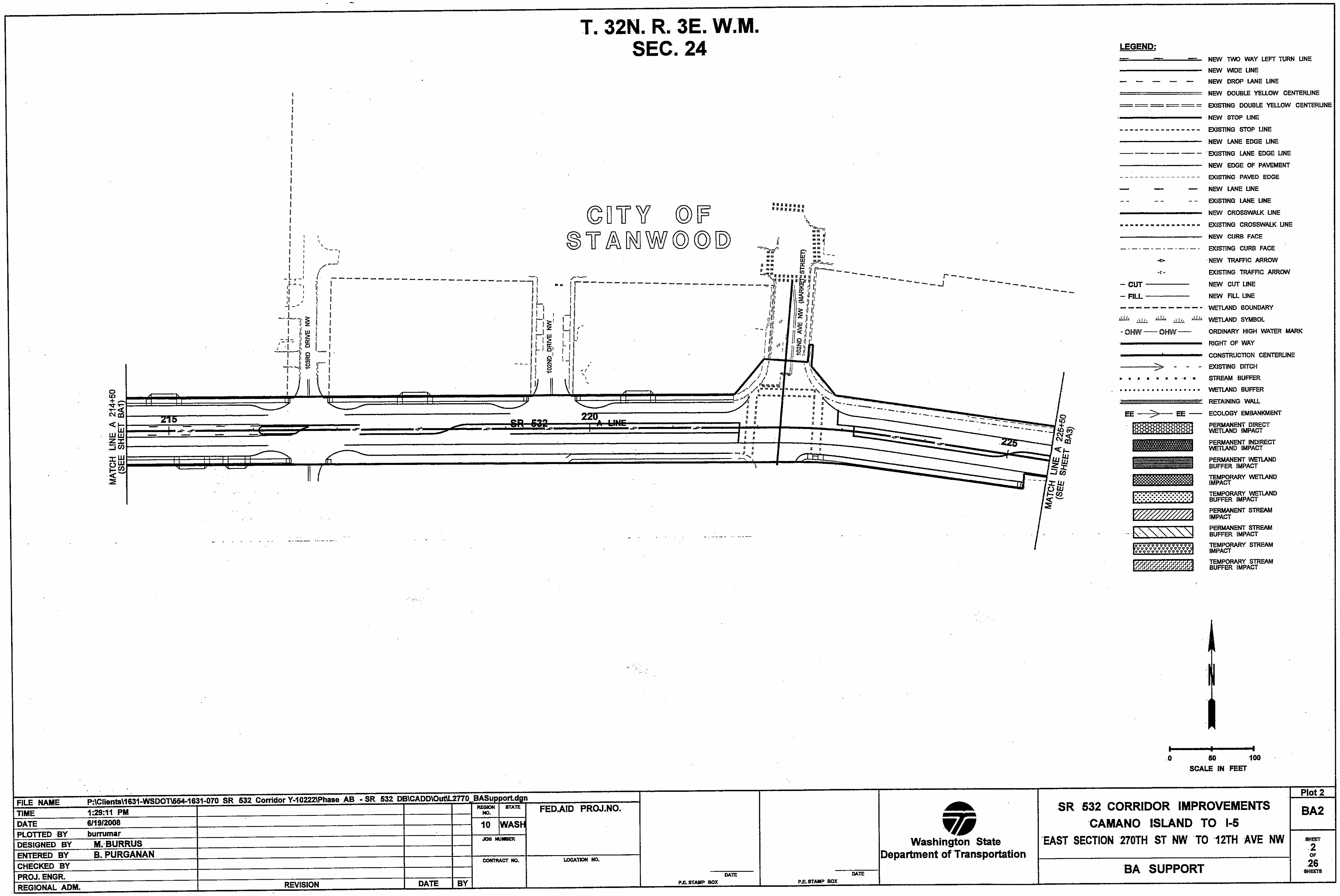
Washington State Department of Transportation
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW
BA SUPPORT
Plot 1
BA1
SHEET 1 OF 26 SHEETS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SEC. 24
CITY OF STANWOOD
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NEW WIDE LINE
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EXISTING DOUBLE YELLOW CENTERLINE
NEW STOP LINE
EXISTING STOP LINE
NEW LANE EDGE LINE
EXISTING LANE EDGE LINE
NEW EDGE OF PAVEMENT
EXISTING PAVED EDGE
NEW LANE LINE
EXISTING LANE LINE
NEW CROSSWALK LINE
EXISTING CROSSWALK LINE
NEW CURB FACE
EXISTING CURB FACE
NEW TRAFFIC ARROW
EXISTING TRAFFIC ARROW
NEW CUT LINE
NEW FILL LINE
WETLAND BOUNDARY
WETLAND SYMBOL
ORDINARY HIGH WATER MARK
RIGHT OF WAY
CONSTRUCTION CENTERLINE
EXISTING DITCH
STREAM BUFFER
WETLAND BUFFER
RETAINING WALL
ECOLOGY EMBANKMENT
PERMANENT DIRECT WETLAND IMPACT
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103RD DRIVE NW
102ND DRIVE NW
102ND AVE NW (MARKET STREET)
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A LINE
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FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO.
LOCATION NO.
P.E. STAMP BOX
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Washington State Department of Transportation
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
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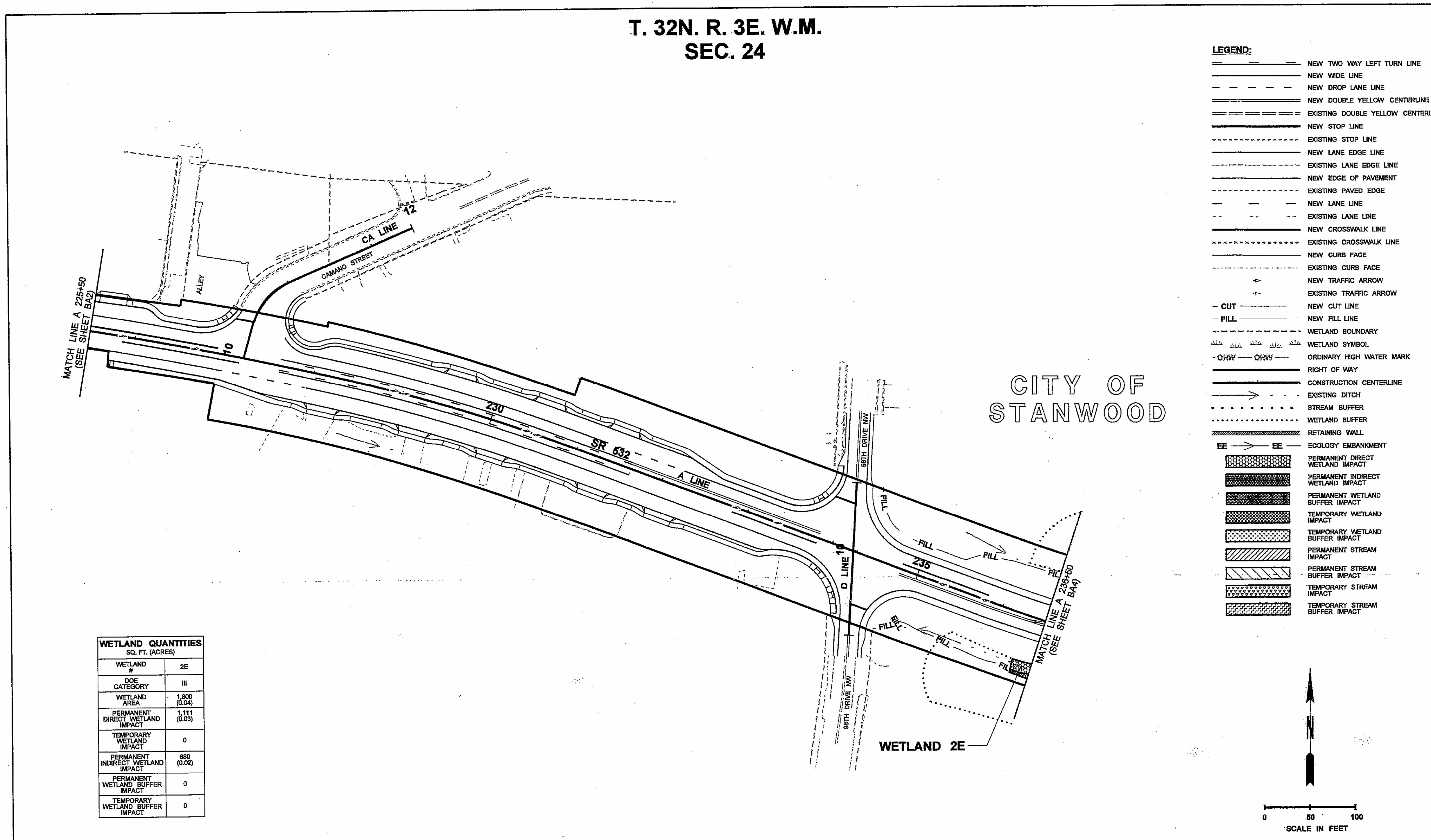
SHEET 2 OF 26 SHEETS



WETLAND QUANTITIES
SQ. FT. (ACRES)

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PERMANENT DIRECT WETLAND IMPACT	1,111 (0.03)
TEMPORARY WETLAND IMPACT	0
PERMANENT INDIRECT WETLAND IMPACT	689 (0.02)
PERMANENT WETLAND BUFFER IMPACT	0
TEMPORARY WETLAND BUFFER IMPACT	0

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JOB NUMBER

CONTRACT NO. | LOCATION NO.

P.E. STAMP BOX DATE

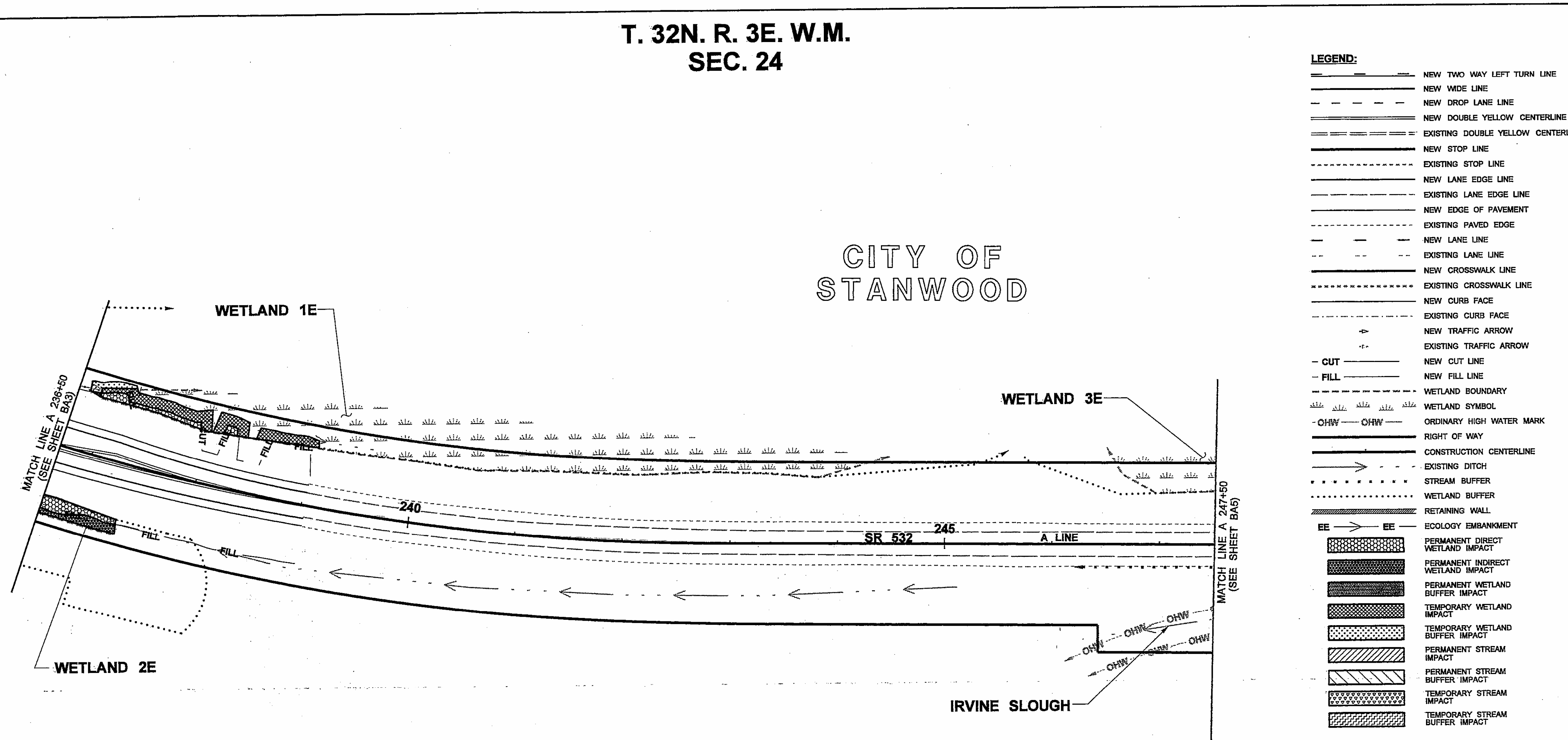
P.E. STAMP BOX DATE

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

BA SUPPORT

Plot 3
BA3
SHEET 3 OF 26 SHEETS



WETLAND QUANTITIES SQ. FT. (ACRES)		
WETLAND #	1E	2E
DOE CATEGORY	III	III
WETLAND AREA	87,119 (2.00)	1,800 (0.04)
PERMANENT DIRECT WETLAND IMPACT	542 (0.01)	1,111 (0.03)
TEMPORARY WETLAND IMPACT	1,988 (0.05)	0
PERMANENT INDIRECT WETLAND IMPACT	0	689 (0.02)
PERMANENT WETLAND BUFFER IMPACT	16 (0.00)	0
TEMPORARY WETLAND BUFFER IMPACT	270 (0.01)	0

N

0 50 100
SCALE IN FEET

FILE NAME	P:\Clients\1631-WSDOT\554-1631-070 SR 532 Corridor Y-10222\Phase AB - SR 532 DB\CADD\Out\L2770_BASupport.dgn			
TIME	1:29:13 PM			
DATE	6/19/2008			
PLOTTED BY	burrumar			
DESIGNED BY	M. BURRUS			
ENTERED BY	B. PURGANAN			
CHECKED BY				
PROJ. ENGR.				
REGIONAL ADM.		REVISION	DATE	BY

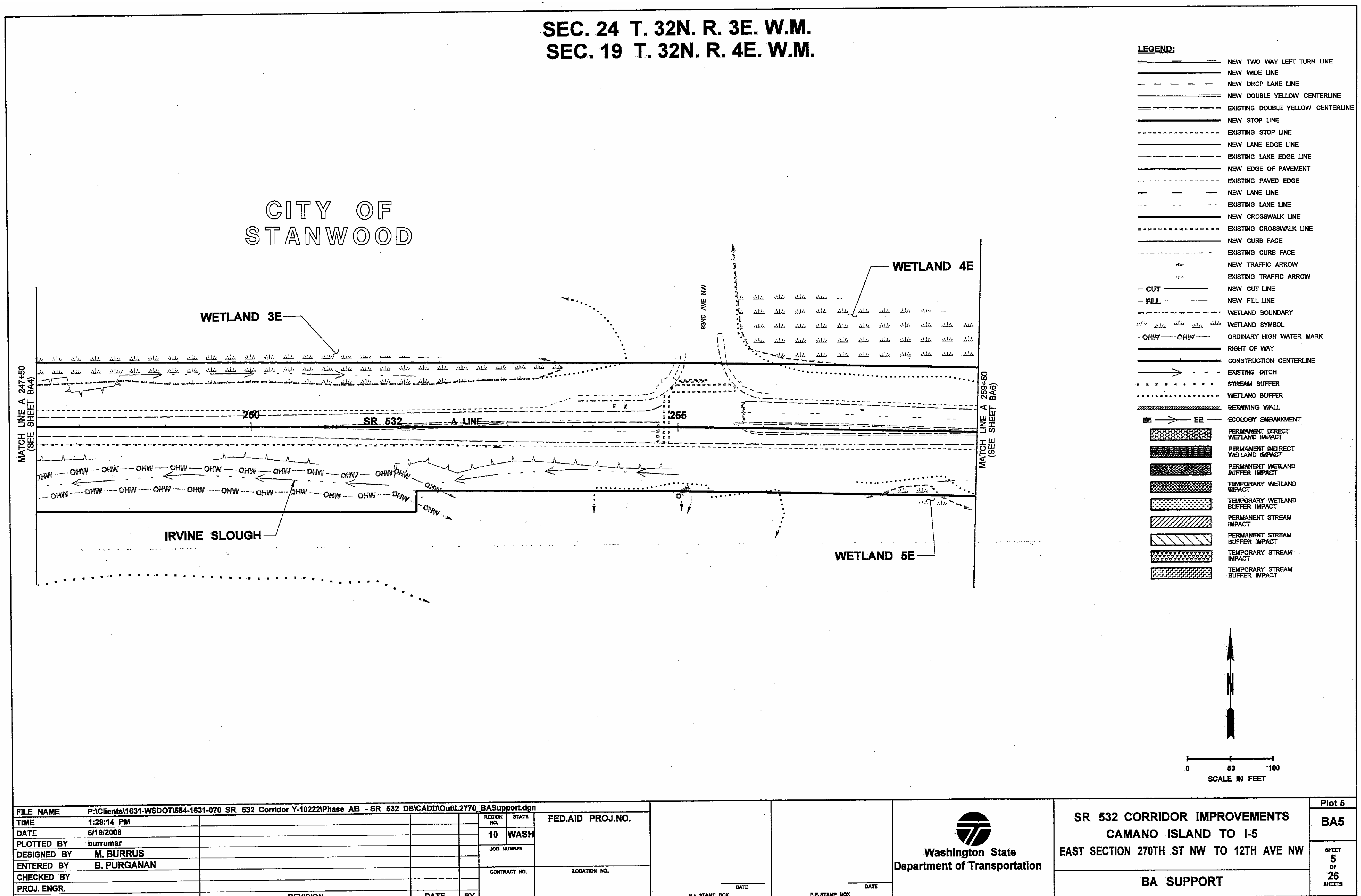
REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO. | LOCATION NO.

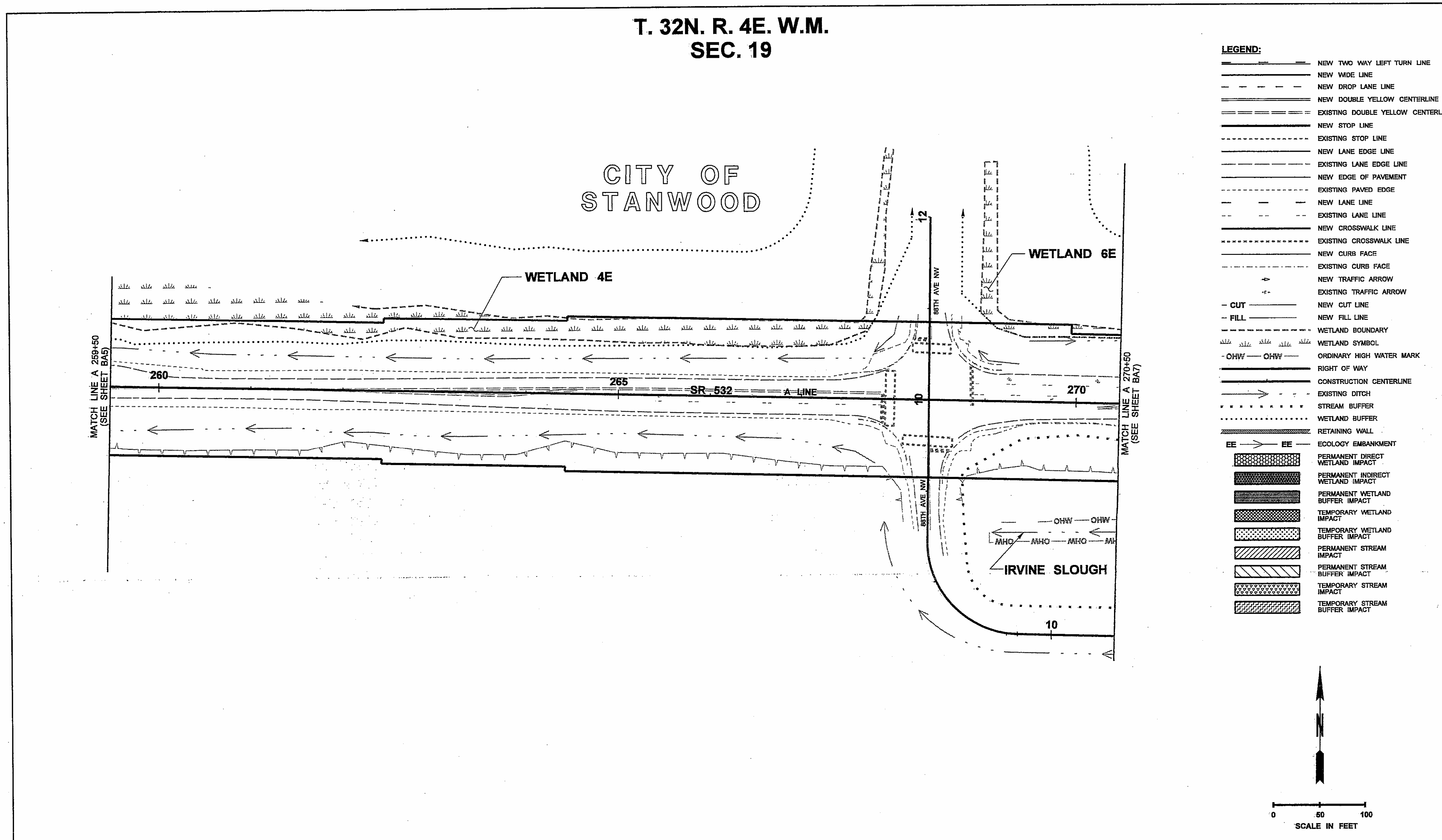
P.E. STAMP BOX — DATE
P.E. STAMP BOX — DATE

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW
BA SUPPORT

Plot 4
BA4
SHEET 4 OF 26 SHEETS


SEC. 24 T. 32N. R. 3E. W.M.
SEC. 19 T. 32N. R. 4E. W.M.
CITY OF STANWOOD
WETLAND 3E
WETLAND 4E
WETLAND 5E
IRVINE SLOUGH
SR 532
A LINE
250
255
92ND AVE NW
MATCH LINE A 247+50 (SEE SHEET BA4)
MATCH LINE A 259+50 (SEE SHEET BA6)
OHW
LEGEND:
NEW TWO WAY LEFT TURN LINE
NEW WIDE LINE
NEW DROP LANE LINE
NEW DOUBLE YELLOW CENTERLINE
EXISTING DOUBLE YELLOW CENTERLINE
NEW STOP LINE
EXISTING STOP LINE
NEW LANE EDGE LINE
EXISTING LANE EDGE LINE
NEW EDGE OF PAVEMENT
EXISTING PAVED EDGE
NEW LANE LINE
EXISTING LANE LINE
NEW CROSSWALK LINE
EXISTING CROSSWALK LINE
NEW CURB FACE
EXISTING CURB FACE
NEW TRAFFIC ARROW
EXISTING TRAFFIC ARROW
CUT NEW CUT LINE
FILL NEW FILL LINE
WETLAND BOUNDARY
WETLAND SYMBOL
OHW ORDINARY HIGH WATER MARK
RIGHT OF WAY
CONSTRUCTION CENTERLINE
EXISTING DITCH
STREAM BUFFER
WETLAND BUFFER
RETAINING WALL
EE ECOLOGY EMBANKMENT
PERMANENT DIRECT WETLAND IMPACT
PERMANENT INDIRECT WETLAND IMPACT
PERMANENT WETLAND BUFFER IMPACT
TEMPORARY WETLAND IMPACT
TEMPORARY WETLAND BUFFER IMPACT
PERMANENT STREAM IMPACT
PERMANENT STREAM BUFFER IMPACT
TEMPORARY STREAM IMPACT
TEMPORARY STREAM BUFFER IMPACT
N
0 50 100
SCALE IN FEET
FILE NAME P:\Clients\1631-WSDOT\554-1631-070 SR 532 Corridor Y-10222\Phase AB - SR 532 DB\CADD\Out\L2770_BASupport.dgn
TIME 1:29:14 PM
DATE 6/19/2008
PLOTTED BY burrumar
DESIGNED BY M. BURRUS
ENTERED BY B. PURGANAN
CHECKED BY
PROJ. ENGR.
REGIONAL ADM.
REVISION
DATE
BY
REGION NO. 10
STATE WASH
FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO.
LOCATION NO.
P.E. STAMP BOX
DATE
Washington State Department of Transportation
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW
BA SUPPORT
Plot 5
BA5
SHEET 5 OF 26 SHEETS



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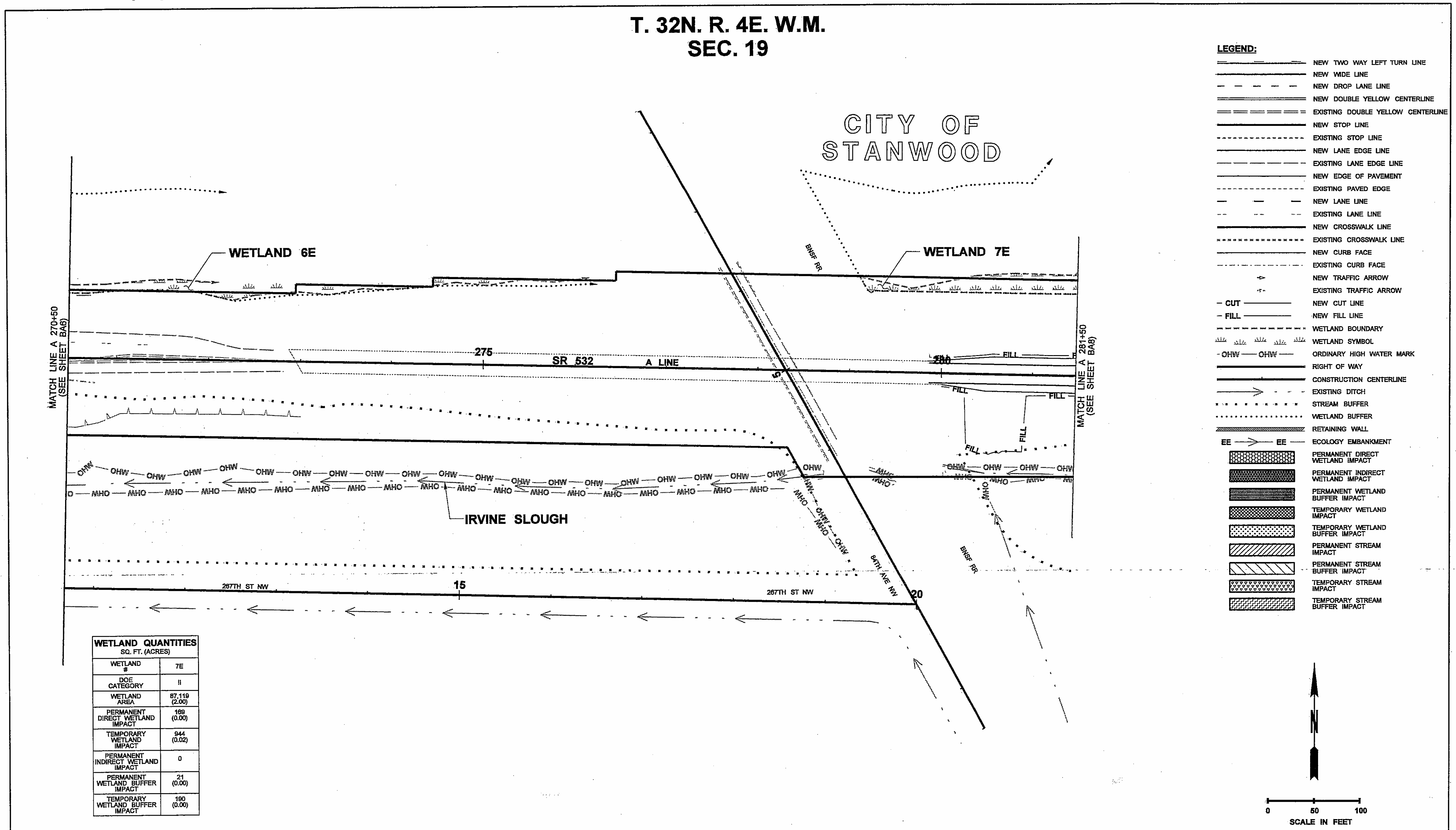
TIME 1:29:15 PM
DATE 6/19/2008
PLOTTED BY burrumar
DESIGNED BY M. BURRUS
ENTERED BY B. PURGANAN
CHECKED BY
PROJ. ENGR.
REGIONAL ADM.
REVISION DATE BY

REGION NO. 10 STATE WASH
FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO.
LOCATION NO.
P.E. STAMP BOX DATE
P.E. STAMP BOX DATE

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW
BA SUPPORT

Plot 6
BA6
SHEET 6 OF 26 SHEETS



WETLAND QUANTITIES SQ. FT. (ACRES)	
WETLAND #	7E
DOE CATEGORY	II
WETLAND AREA	87,119 (2.00)
PERMANENT DIRECT WETLAND IMPACT	169 (0.00)
TEMPORARY WETLAND IMPACT	944 (0.02)
PERMANENT INDIRECT WETLAND IMPACT	0
PERMANENT WETLAND BUFFER IMPACT	21 (0.00)
TEMPORARY WETLAND BUFFER IMPACT	190 (0.00)

FILE NAME	P:\Clients\1631-WSDOT\554-1631-070 SR 532 Corridor Y-10222\Phase AB - SR 532 DB\CADD\Out\L2770_BASupport.dgn
TIME	1:29:16 PM
DATE	6/19/2008
PLOTTED BY	burrumar
DESIGNED BY	M. BURRUS
ENTERED BY	B. PURGANAN
CHECKED BY	
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

JOB NUMBER

CONTRACT NO. | LOCATION NO.

P.E. STAMP BOX DATE

P.E. STAMP BOX DATE

Washington State Department of Transportation

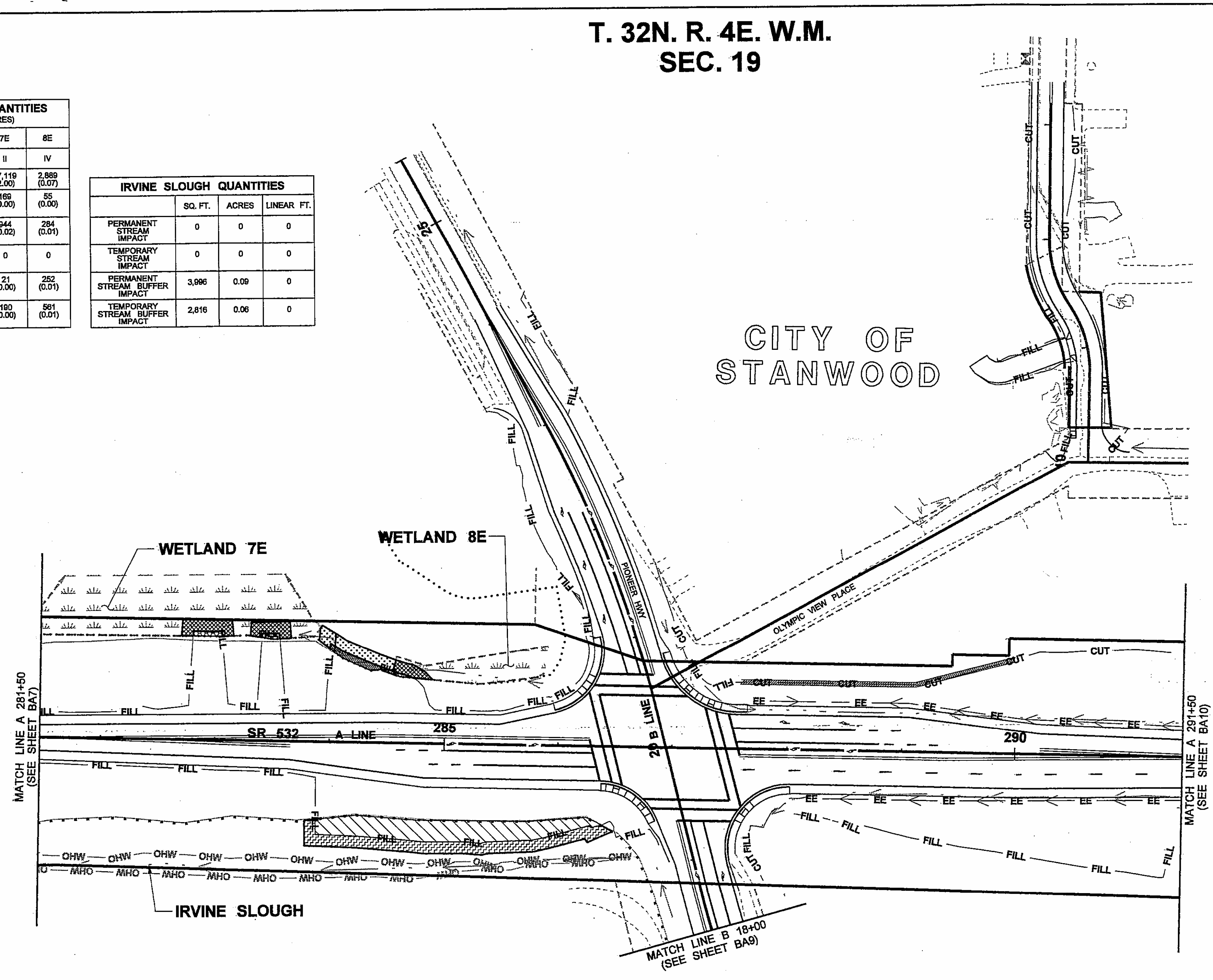
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

BA SUPPORT

Plot 7
BA7
SHEET 7 OF 26 SHEETS

WETLAND QUANTITIES SQ. FT. (ACRES)		
WETLAND #	7E	8E
DOE CATEGORY	II	IV
WETLAND AREA	87,119 (2.00)	2,889 (0.07)
PERMANENT DIRECT WETLAND IMPACT	169 (0.00)	55 (0.00)
TEMPORARY WETLAND IMPACT	944 (0.02)	284 (0.01)
PERMANENT INDIRECT WETLAND IMPACT	0	0
PERMANENT WETLAND BUFFER IMPACT	21 (0.00)	252 (0.01)
TEMPORARY WETLAND BUFFER IMPACT	190 (0.00)	561 (0.01)

IRVINE SLOUGH QUANTITIES			
	SQ. FT.	ACRES	LINEAR FT.
PERMANENT STREAM IMPACT	0	0	0
TEMPORARY STREAM IMPACT	0	0	0
PERMANENT STREAM BUFFER IMPACT	3,996	0.09	0
TEMPORARY STREAM BUFFER IMPACT	2,816	0.06	0



LEGEND:

- NEW TWO WAY LEFT TURN LINE
- NEW WIDE LINE
- NEW DROP LANE LINE
- NEW DOUBLE YELLOW CENTERLINE
- EXISTING DOUBLE YELLOW CENTERLINE
- NEW STOP LINE
- EXISTING STOP LINE
- NEW LANE EDGE LINE
- EXISTING LANE EDGE LINE
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- NEW LANE LINE
- EXISTING LANE LINE
- NEW CROSSWALK LINE
- EXISTING CROSSWALK LINE
- NEW CURB FACE
- EXISTING CURB FACE
- NEW TRAFFIC ARROW
- EXISTING TRAFFIC ARROW
- CUT — NEW CUT LINE
- FILL — NEW FILL LINE
- WETLAND BOUNDARY
- WETLAND SYMBOL
- OHW — OHW — ORDINARY HIGH WATER MARK
- RIGHT OF WAY
- CONSTRUCTION CENTERLINE
- EXISTING DITCH
- STREAM BUFFER
- WETLAND BUFFER
- RETAINING WALL
- EE — EE — ECOLOGY EMBANKMENT
- PERMANENT DIRECT WETLAND IMPACT
- PERMANENT INDIRECT WETLAND IMPACT
- PERMANENT WETLAND BUFFER IMPACT
- TEMPORARY WETLAND IMPACT
- TEMPORARY WETLAND BUFFER IMPACT
- PERMANENT STREAM IMPACT
- PERMANENT STREAM BUFFER IMPACT
- TEMPORARY STREAM IMPACT
- TEMPORARY STREAM BUFFER IMPACT

N

0 50 100
SCALE IN FEET

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TIME	2:47:58 PM
DATE	6/19/2008
PLOTTED BY	burrumar
DESIGNED BY	M. BURRUS
ENTERED BY	B. PURGANAN
CHECKED BY	
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

JOB NUMBER

CONTRACT NO. | LOCATION NO.

DATE P.E. STAMP BOX

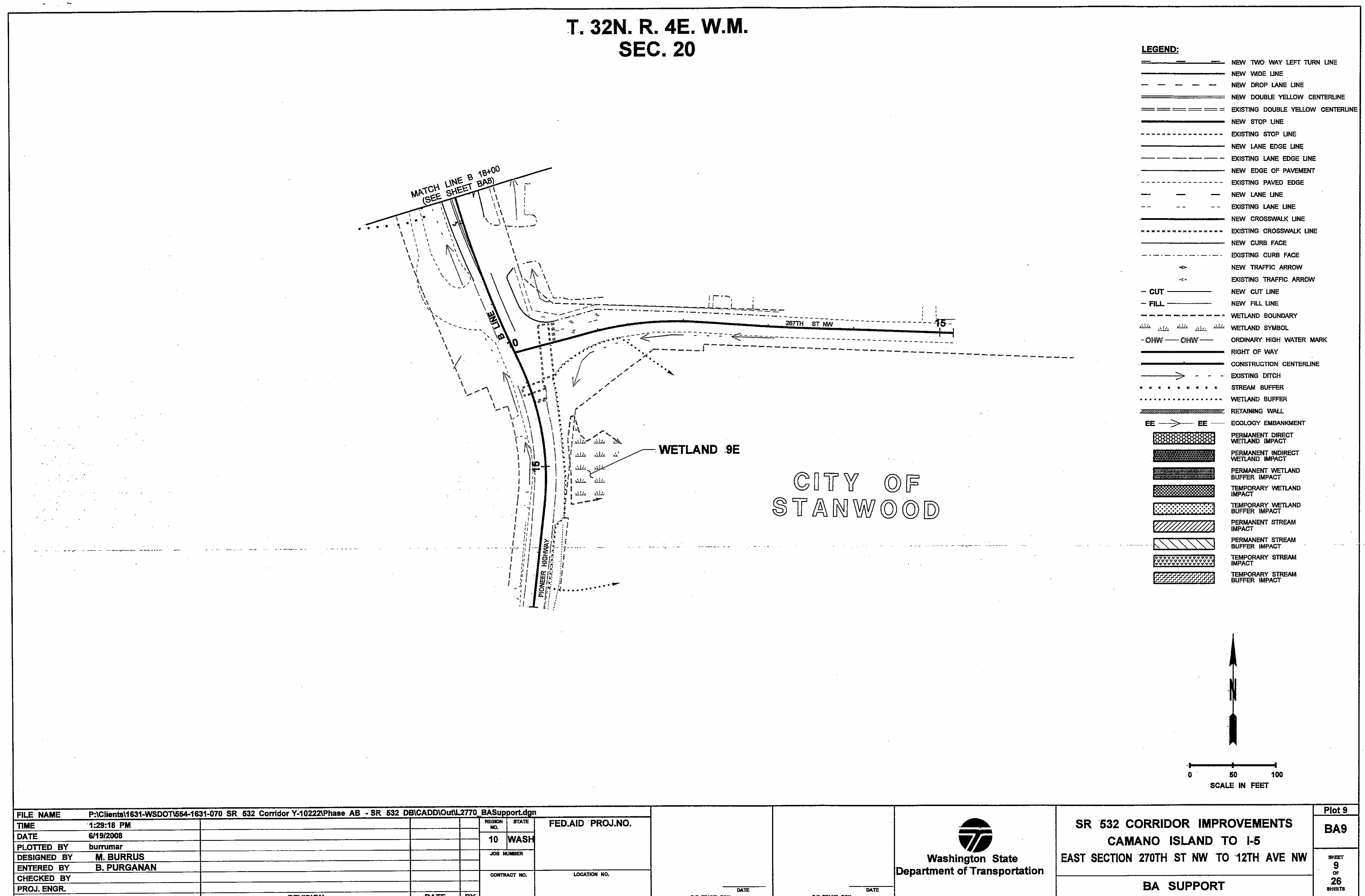
DATE P.E. STAMP BOX

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

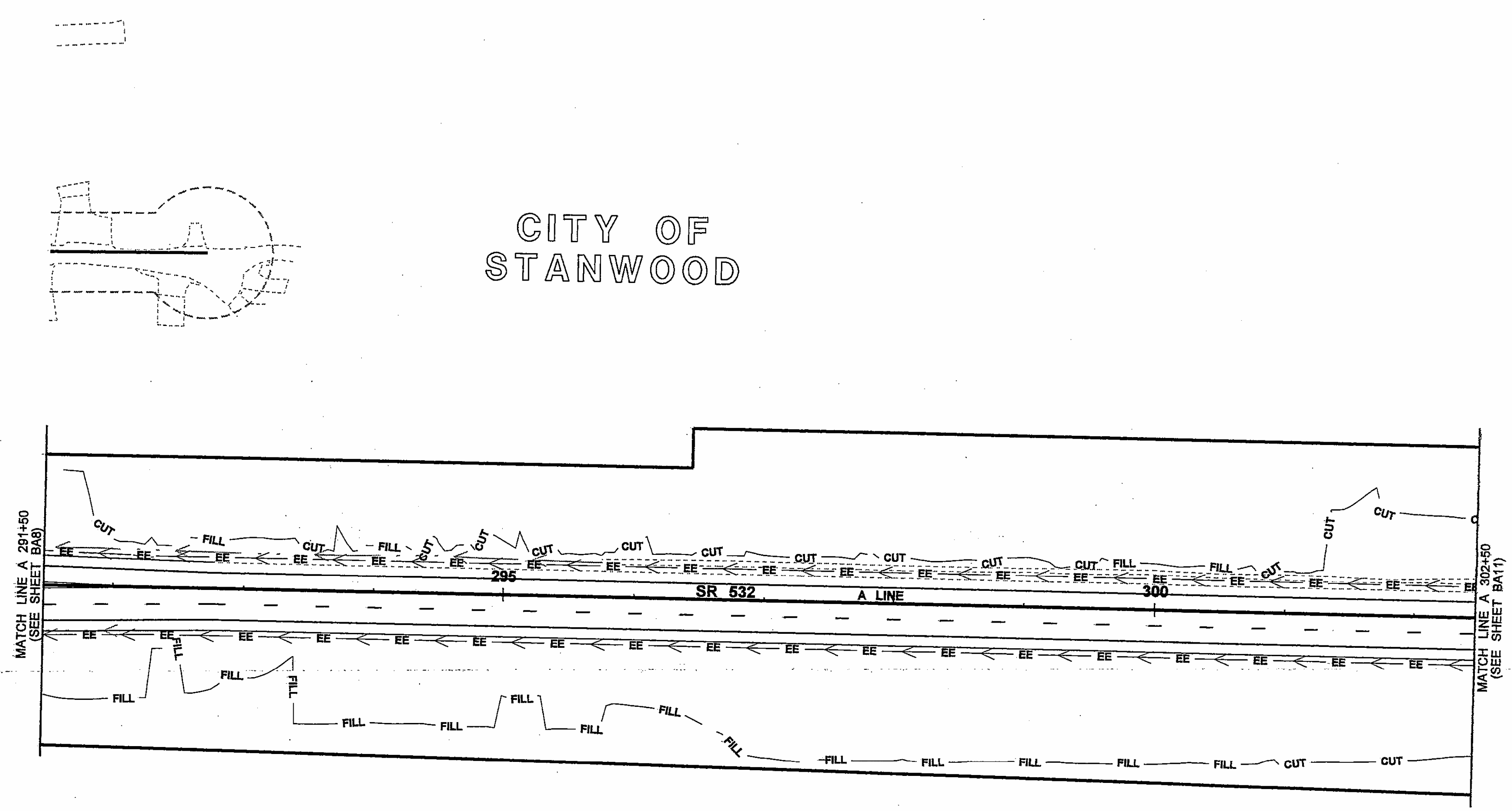
BA SUPPORT

Plot 8
BA8
SHEET 8 OF 26 SHEETS



T. 32N. R. 4E. W.M.
SEC. 20
LEGEND:
NEW TWO WAY LEFT TURN LINE
NEW WIDE LINE
NEW DROP LANE LINE
NEW DOUBLE YELLOW CENTERLINE
EXISTING DOUBLE YELLOW CENTERLINE
NEW STOP LINE
EXISTING STOP LINE
NEW LANE EDGE LINE
EXISTING LANE EDGE LINE
NEW EDGE OF PAVEMENT
EXISTING PAVED EDGE
NEW LANE LINE
EXISTING LANE LINE
NEW CROSSWALK LINE
EXISTING CROSSWALK LINE
NEW CURB FACE
EXISTING CURB FACE
NEW TRAFFIC ARROW
EXISTING TRAFFIC ARROW
CUT
NEW CUT LINE
FILL
NEW FILL LINE
WETLAND BOUNDARY
WETLAND SYMBOL
OHW
ORDINARY HIGH WATER MARK
RIGHT OF WAY
CONSTRUCTION CENTERLINE
EXISTING DITCH
STREAM BUFFER
WETLAND BUFFER
RETAINING WALL
EE
ECOLOGY EMBANKMENT
PERMANENT DIRECT WETLAND IMPACT
PERMANENT INDIRECT WETLAND IMPACT
PERMANENT WETLAND BUFFER IMPACT
TEMPORARY WETLAND IMPACT
TEMPORARY WETLAND BUFFER IMPACT
PERMANENT STREAM IMPACT
PERMANENT STREAM BUFFER IMPACT
TEMPORARY STREAM IMPACT
TEMPORARY STREAM BUFFER IMPACT
MATCH LINE B 18+00
(SEE SHEET BA8)
B LINE
0
15
267TH ST NW
15
WETLAND 9E
PIONEER HIGHWAY
CITY OF
STANWOOD
N
0
50
100
SCALE IN FEET
FILE NAME P:\Clients\1631-WSDOT\554-1631-070 SR 532 Corridor Y-10222\Phase AB - SR 532 DB\CADD\Out\L2770_BASupport.dgn
TIME 1:29:18 PM
DATE 6/19/2008
PLOTTED BY burrumar
DESIGNED BY M. BURRUS
ENTERED BY B. PURGANAN
CHECKED BY
PROJ. ENGR.
REGIONAL ADM.
REVISION
DATE
BY
REGION NO.
STATE
10
WASH
FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO.
LOCATION NO.
DATE
P.E. STAMP BOX
DATE
P.E. STAMP BOX
Washington State
Department of Transportation
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW
BA SUPPORT
Plot 9
BA9
SHEET
9
OF
26
SHEETS

T. 32N. R. 4E. W.M.
SEC. 19



LEGEND:

- NEW TWO WAY LEFT TURN LINE
- NEW WIDE LINE
- NEW DROP LANE LINE
- NEW DOUBLE YELLOW CENTERLINE
- EXISTING DOUBLE YELLOW CENTERLINE
- NEW STOP LINE
- EXISTING STOP LINE
- NEW LANE EDGE LINE
- EXISTING LANE EDGE LINE
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- NEW LANE LINE
- EXISTING LANE LINE
- NEW CROSSWALK LINE
- EXISTING CROSSWALK LINE
- NEW CURB FACE
- EXISTING CURB FACE
- NEW TRAFFIC ARROW
- EXISTING TRAFFIC ARROW
- CUT — NEW CUT LINE
- FILL — NEW FILL LINE
- WETLAND BOUNDARY
- WETLAND SYMBOL
- OHW — OHW — ORDINARY HIGH WATER MARK
- RIGHT OF WAY
- CONSTRUCTION CENTERLINE
- EXISTING DITCH
- STREAM BUFFER
- WETLAND BUFFER
- RETAINING WALL
- EE — EE — ECOLOGY EMBANKMENT
- PERMANENT DIRECT WETLAND IMPACT
- PERMANENT INDIRECT WETLAND IMPACT
- PERMANENT WETLAND BUFFER IMPACT
- TEMPORARY WETLAND IMPACT
- TEMPORARY WETLAND BUFFER IMPACT
- PERMANENT STREAM IMPACT
- PERMANENT STREAM BUFFER IMPACT
- TEMPORARY STREAM IMPACT
- TEMPORARY STREAM BUFFER IMPACT

N

0 50 100
SCALE IN FEET

FILE NAME	P:\Clients\1631-WSDOT\554-1631-070 SR 532 Corridor Y-10222\Phase AB - SR 532 DB\CADD\Out\L2770_BASupport.dgn
TIME	1:29:18 PM
DATE	6/19/2008
PLOTTED BY	burrumar
DESIGNED BY	M. BURRUS
ENTERED BY	B. PURGANAN
CHECKED BY	
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO. | LOCATION NO.

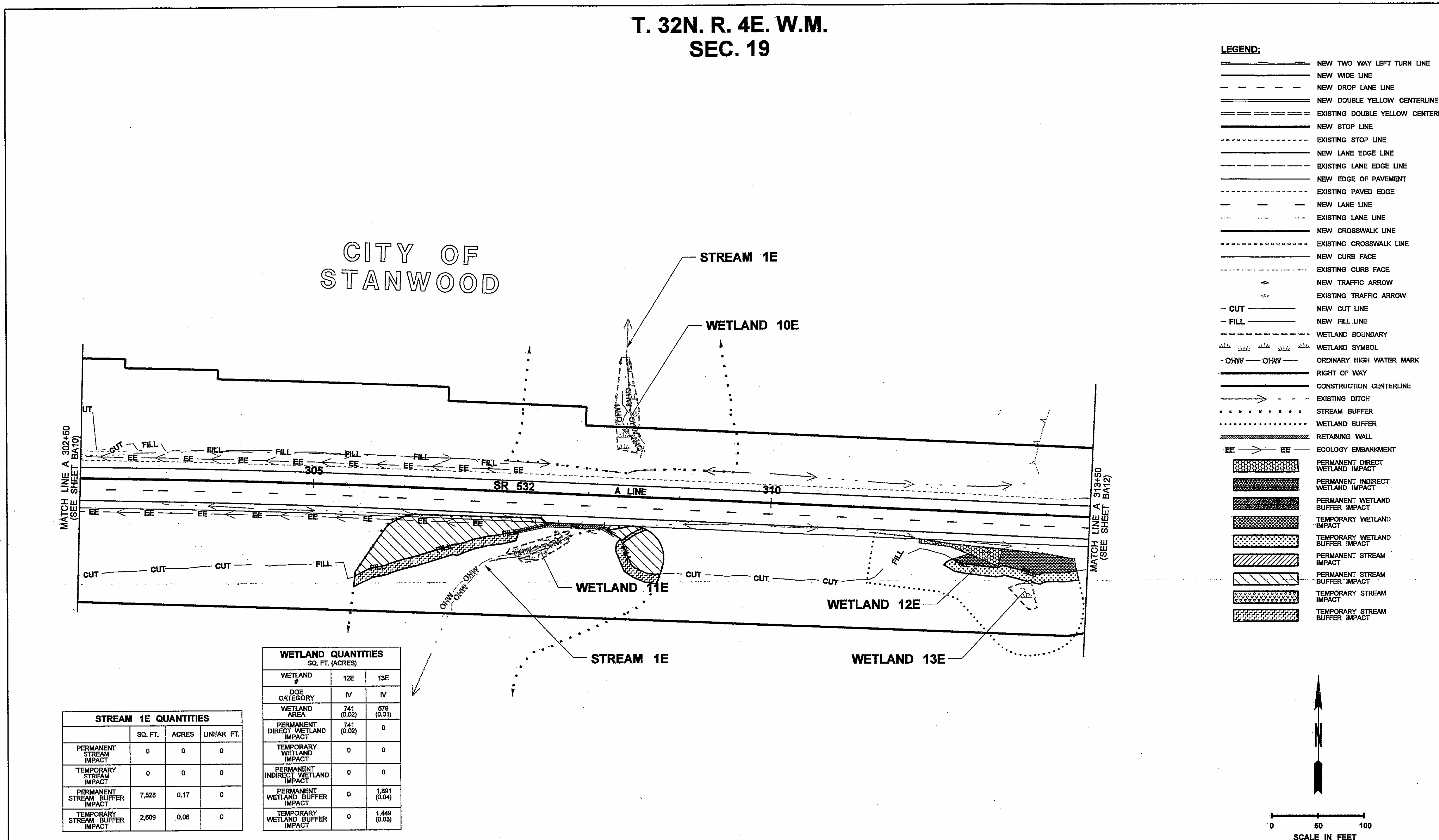
P.E. STAMP BOX — DATE
P.E. STAMP BOX — DATE

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW
BA SUPPORT

Plot 10
BA10
SHEET 10 OF 26 SHEETS

T. 32N. R. 4E. W.M.
SEC. 19



STREAM 1E QUANTITIES			
	SQ. FT.	ACRES	LINEAR FT.
PERMANENT STREAM IMPACT	0	0	0
TEMPORARY STREAM IMPACT	0	0	0
PERMANENT STREAM BUFFER IMPACT	7,528	0.17	0
TEMPORARY STREAM BUFFER IMPACT	2,609	0.06	0

WETLAND QUANTITIES SQ. FT. (ACRES)		
WETLAND #	12E	13E
DOE CATEGORY	IV	IV
WETLAND AREA	741 (0.02)	579 (0.01)
PERMANENT DIRECT WETLAND IMPACT	741 (0.02)	0
TEMPORARY WETLAND IMPACT	0	0
PERMANENT INDIRECT WETLAND IMPACT	0	0
PERMANENT WETLAND BUFFER IMPACT	0	1,891 (0.04)
TEMPORARY WETLAND BUFFER IMPACT	0	1,449 (0.03)

FILE NAME	P:\Clients\1631-WSDOT\554-1631-070 SR 532 Corridor Y-10222\Phase AB - SR 532 DB\CADD\Out\L2770_BASupport.dgn
TIME	1:29:19 PM
DATE	6/19/2008
PLOTTED BY	burrumar
DESIGNED BY	M. BURRUS
ENTERED BY	B. PURGANAN
CHECKED BY	
PROJ. ENGR.	
REGIONAL ADM.	

REVISION	DATE	BY

REGION NO.	STATE	FED.AID PROJ.NO.
10	WASH	

JOB NUMBER

CONTRACT NO. LOCATION NO.

P.E. STAMP BOX DATE

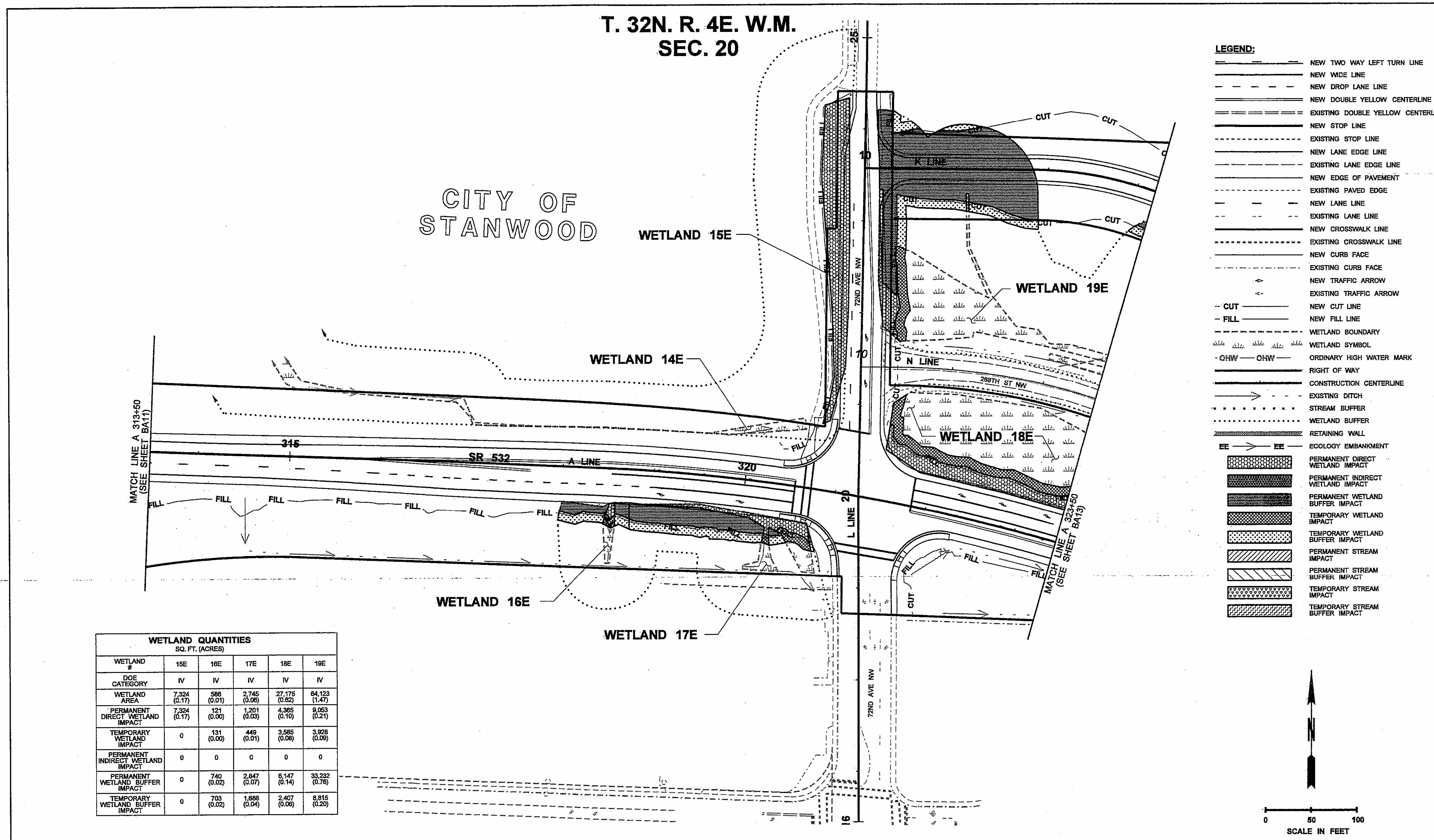
P.E. STAMP BOX DATE

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

BA SUPPORT

Plot 11
BA11
SHEET 11 OF 26 SHEETS



WETLAND QUANTITIES
SQ. FT. (ACRES)

WETLAND #	15E	16E	17E	18E	19E
DOE CATEGORY	IV	IV	IV	IV	IV
WETLAND AREA	7,324 (0.17)	586 (0.01)	2,745 (0.06)	27,175 (0.62)	64,123 (1.47)
PERMANENT DIRECT WETLAND IMPACT	7,324 (0.17)	121 (0.00)	1,201 (0.03)	4,365 (0.10)	9,053 (0.21)
TEMPORARY WETLAND IMPACT	0	131 (0.00)	449 (0.01)	3,585 (0.08)	3,928 (0.09)
PERMANENT INDIRECT WETLAND IMPACT	0	0	0	0	0
PERMANENT WETLAND BUFFER IMPACT	0	740 (0.02)	2,847 (0.07)	6,147 (0.14)	33,232 (0.76)
TEMPORARY WETLAND BUFFER IMPACT	0	703 (0.02)	1,688 (0.04)	2,407 (0.06)	8,815 (0.20)

FILE NAME	P:\Clients\1631-WSDOT\554-1631-070 SR 532 Corridor Y-10222\Phase AB - SR 532 DB\CADD\Out\L2770_BASupport.dgn
TIME	1:29:20 PM
DATE	6/19/2008
PLOTTED BY	burrumar
DESIGNED BY	M. BURRUS
ENTERED BY	B. PURGANAN
CHECKED BY	
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

JOB NUMBER

CONTRACT NO. | LOCATION NO.

P.E. STAMP BOX DATE | P.E. STAMP BOX DATE

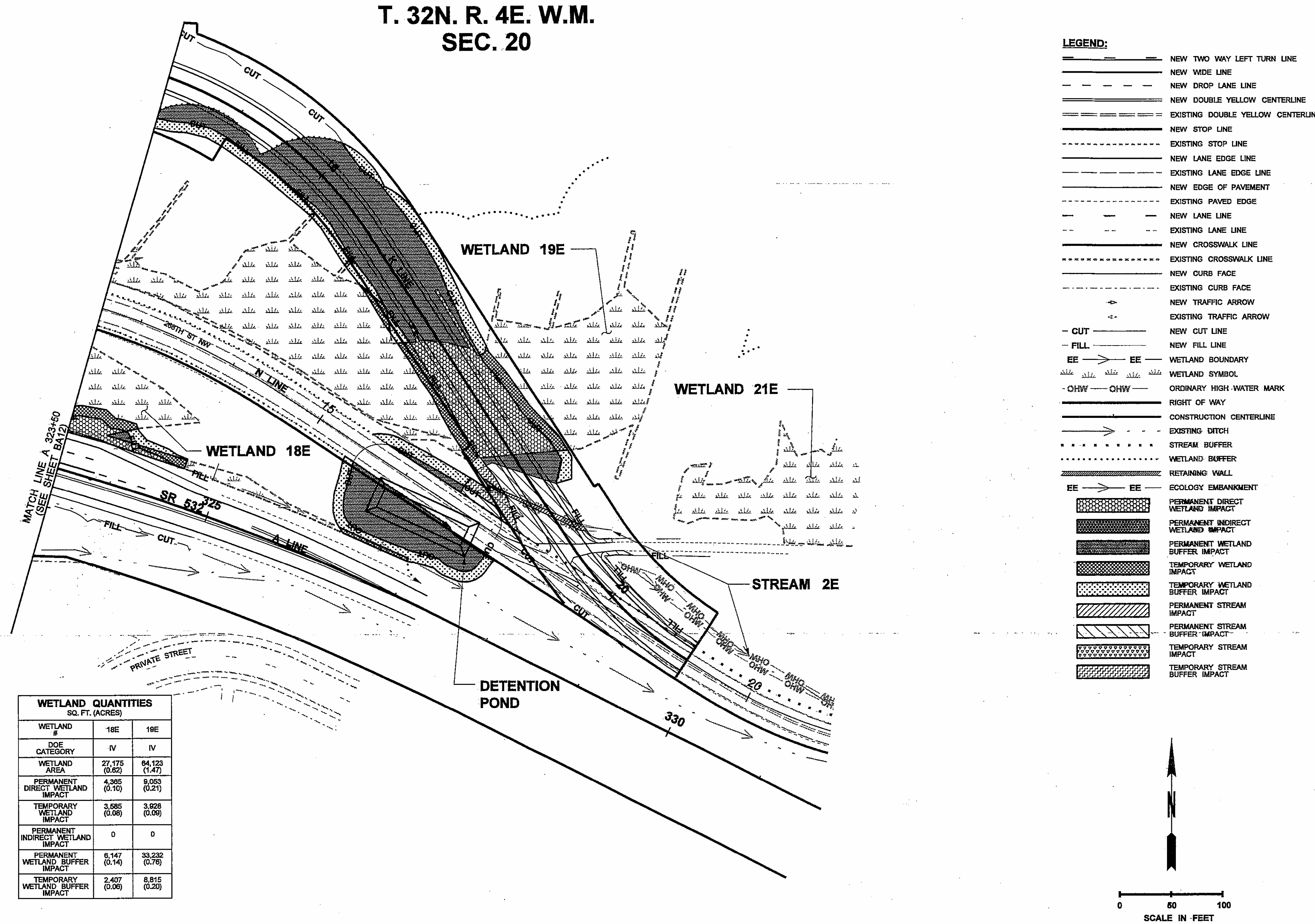
Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

BA SUPPORT

Plot 12
BA12
SHEET 12 OF 26 SHEETS

T. 32N. R. 4E. W.M.
SEC. 20



STREAM 2E QUANTITIES			
	SQ. FT.	ACRES	LINEAR FT.
PERMANENT STREAM IMPACT	338	0.01	88
TEMPORARY STREAM IMPACT	53	0.00	24
PERMANENT STREAM BUFFER IMPACT	6,033	0.14	0
TEMPORARY STREAM BUFFER IMPACT	980	0.02	0

WETLAND QUANTITIES SQ. FT. (ACRES)		
WETLAND #	18E	19E
DOE CATEGORY	IV	IV
WETLAND AREA	27,175 (0.62)	64,123 (1.47)
PERMANENT DIRECT WETLAND IMPACT	4,365 (0.10)	9,053 (0.21)
TEMPORARY WETLAND IMPACT	3,585 (0.08)	3,928 (0.09)
PERMANENT INDIRECT WETLAND IMPACT	0	0
PERMANENT WETLAND BUFFER IMPACT	6,147 (0.14)	33,232 (0.76)
TEMPORARY WETLAND BUFFER IMPACT	2,407 (0.06)	8,815 (0.20)

FILE NAME	P:\Clients\1631-WSDOT\554-1631-070 SR 532 Corridor Y-10222\Phase AB - SR 532 DB\CADD\Out\L2770_BASupport.dgn
TIME	1:29:22 PM
DATE	6/19/2008
PLOTTED BY	burrumar
DESIGNED BY	M. BURRUS
ENTERED BY	B. PURGANAN
CHECKED BY	
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

JOB NUMBER

CONTRACT NO. | LOCATION NO.

DATE P.E. STAMP BOX | DATE P.E. STAMP BOX

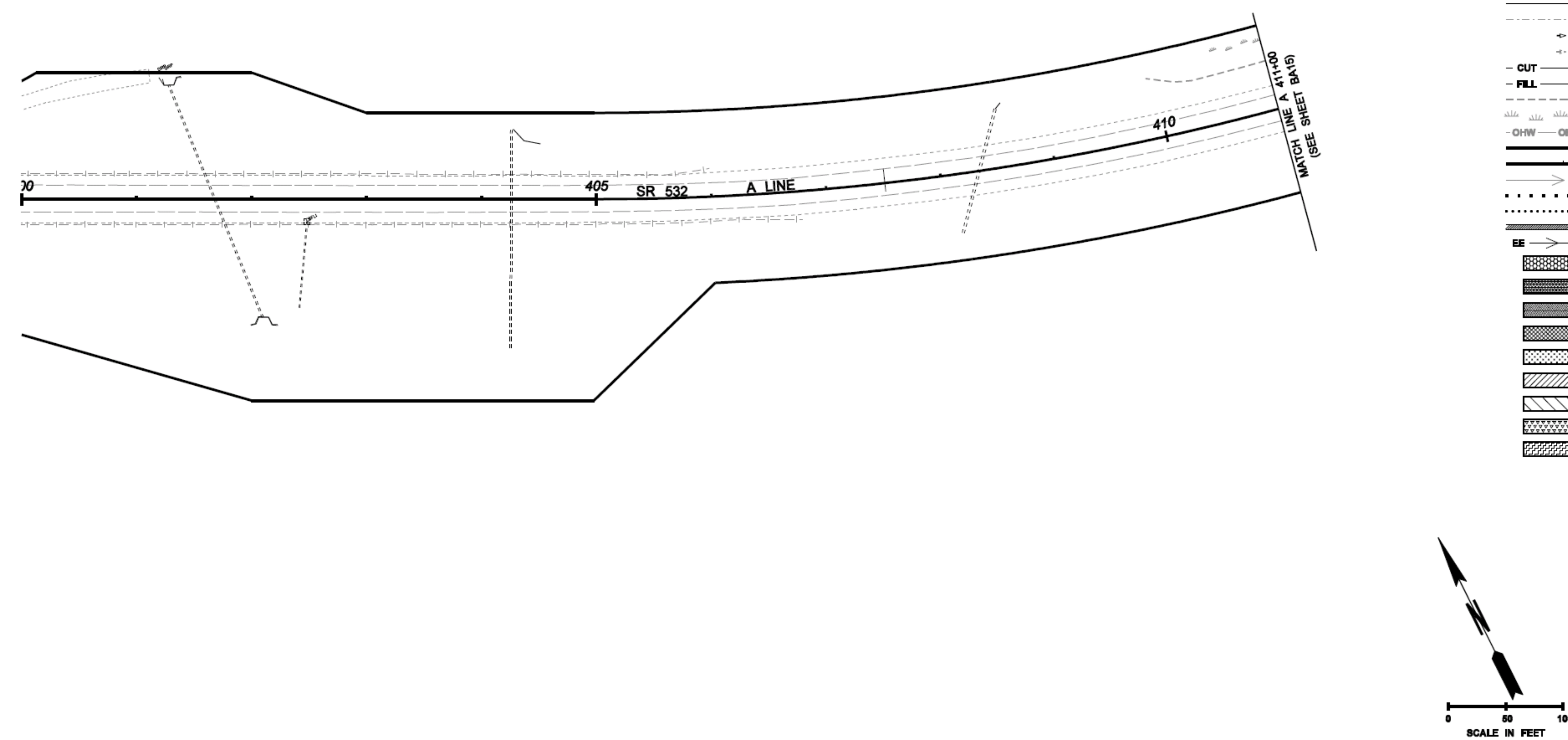
Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

BA SUPPORT

Plot 13
BA13
SHEET 13 OF 26 SHEETS

T.32 N. R.4E. W.M. SEC. 29



LEGEND:

- NEW TWO WAY LEFT TURN LINE
- NEW WIDE LINE
- NEW DROP LANE LINE
- NEW DOUBLE YELLOW CENTERLINE
- EXISTING DOUBLE YELLOW CENTERLINE
- NEW STOP LINE
- EXISTING STOP LINE
- NEW LANE EDGE LINE
- EXISTING LANE EDGE LINE
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- NEW LANE LINE
- EXISTING LANE LINE
- NEW CROSSWALK LINE
- EXISTING CROSSWALK LINE
- NEW CURB FACE
- EXISTING CURB FACE
- NEW TRAFFIC ARROW
- EXISTING TRAFFIC ARROW
- CUT — NEW CUT LINE
- FILL — NEW FILL LINE
- WETLAND BOUNDARY
- WETLAND SYMBOL
- OHW — ORDINARY HIGH WATER MARK
- RIGHT OF WAY
- CONSTRUCTION CENTERLINE
- EXISTING DITCH
- STREAM BUFFER
- WETLAND BUFFER
- RETAINING WALL
- EE — ECOLOGY EMBANKMENT
- PERMANENT DIRECT WETLAND IMPACT
- PERMANENT INDIRECT WETLAND IMPACT
- PERMANENT WETLAND BUFFER IMPACT
- TEMPORARY WETLAND IMPACT
- TEMPORARY WETLAND BUFFER IMPACT
- PERMANENT STREAM IMPACT
- PERMANENT STREAM BUFFER IMPACT
- TEMPORARY STREAM IMPACT
- TEMPORARY STREAM BUFFER IMPACT

FILE NAME	K:\project\31200\31238\XL2770\CADD\PS&ESheets\l2770_PS_BA_SN-XFP.dgn			
TIME	10:14:46 AM			
DATE	6/30/2008			
PLOTTED BY	charlinet			
DESIGNED BY	J. ANDREWS			
ENTERED BY	C. FOX			
CHECKED BY				
PROJ. ENGR.				
REGIONAL ADM.		REVISION	DATE	BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO. | LOCATION NO.

P.E. STAMP BOX | DATE

otak Incorporated
10230 NE Points Drive
Suite 400
Kirkland, Washington 98033
Phone: (425) 822-4446
FAX: (425) 827-9577
Internet: WWW.Otak.COM

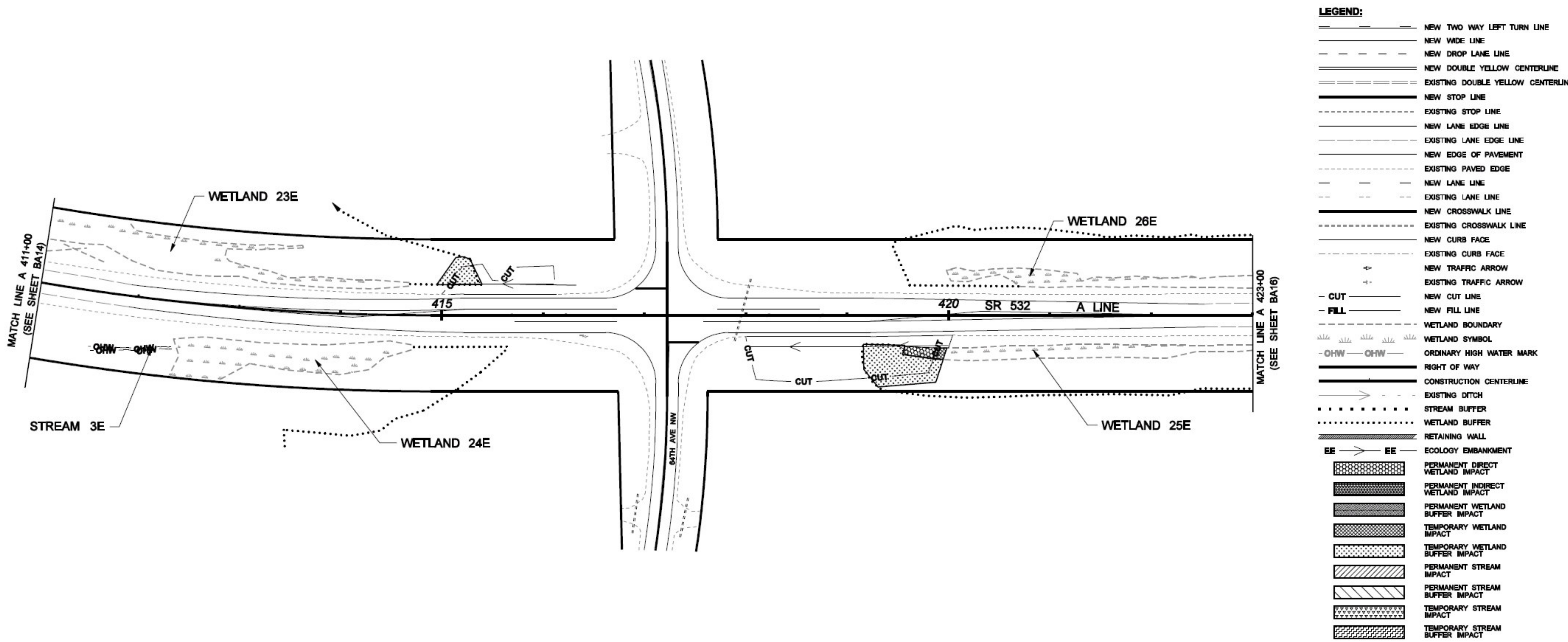
Washington State Department of Transportation

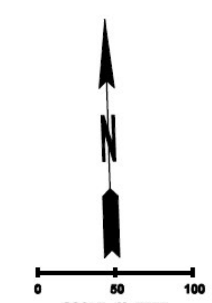
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

BA SUPPORT

Plot 1
BA14
SHEET 14 OF 26 SHEETS

T.32 N. R.4E. W.M. SEC. 29





WETLAND QUANTITIES
SQ. FT. (ACRES)

WETLAND #	23E	25E
DOE CATEGORY	III	IV
WETLAND AREA	217,798 (5.00)	4,224 (0.10)
PERMANENT DIRECT WETLAND IMPACT	0	293 (0.01)
TEMPORARY WETLAND IMPACT	0	118 (<0.01)
PERMANENT INDIRECT WETLAND IMPACT	0	0
PERMANENT WETLAND BUFFER IMPACT	0	0
TEMPORARY WETLAND BUFFER IMPACT	782 (0.02)	2,423 (0.06)

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PLOTTED BY	charlinet
DESIGNED BY	J. ANDREWS
ENTERED BY	C. FOX
CHECKED BY	
PROJ. ENGR.	
REGIONAL ADM.	

REVISION	DATE	BY

REGION NO.	STATE	FED.AID PROJ.NO.
10	WASH	
JOB NUMBER		
CONTRACT NO.		LOCATION NO.

P.E. STAMP BOX DATE

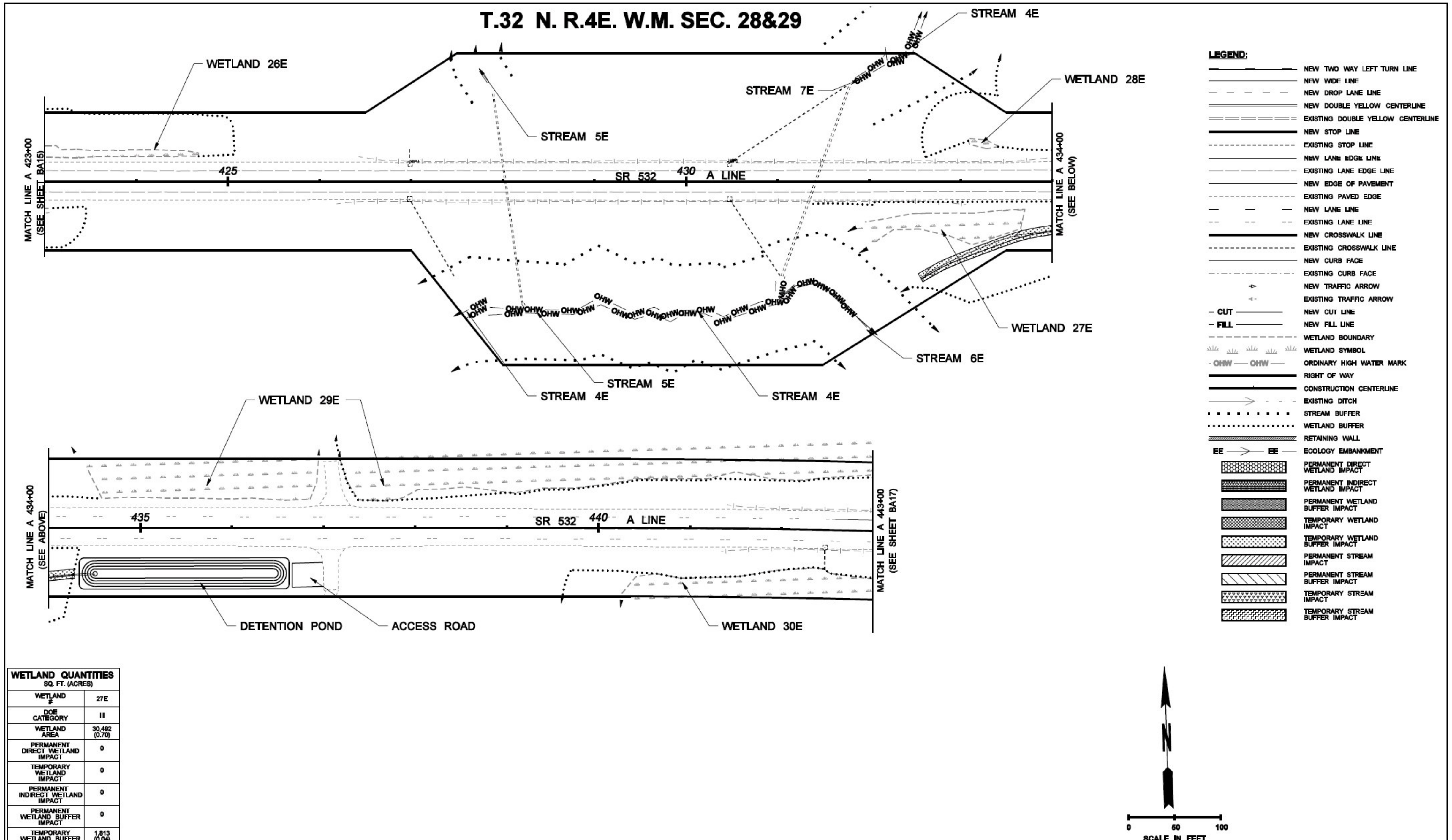
otak Incorporated
10230 NE Points Drive
Suite 400
Kirkland, Washington 98033
Phone: (425) 822-4446
FAX: (425) 827-9577
Internet: WWW.Otak.COM

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

BA SUPPORT

Plot 2
BA15
SHEET 15 OF 26 SHEETS



WETLAND QUANTITIES SQ. FT. (ACRES)	
WETLAND #	27E
DOE CATEGORY	III
WETLAND AREA	30,492 (0.70)
PERMANENT DIRECT WETLAND IMPACT	0
TEMPORARY WETLAND IMPACT	0
PERMANENT INDIRECT WETLAND IMPACT	0
PERMANENT WETLAND BUFFER IMPACT	0
TEMPORARY WETLAND BUFFER IMPACT	1,813 (0.04)

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PROJ. ENGR.	
REGIONAL ADM.	

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JOB NUMBER

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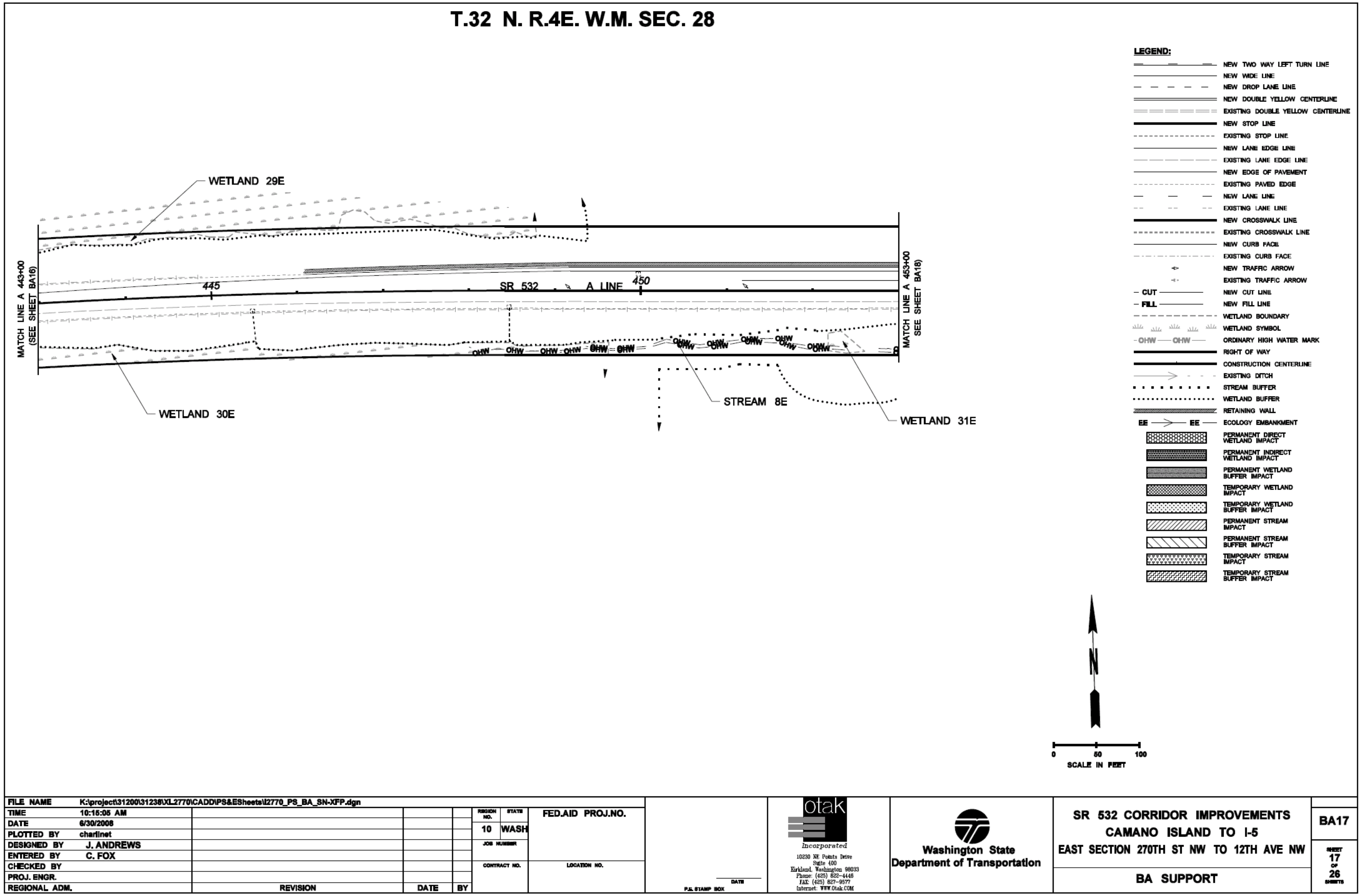
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

BA SUPPORT

Plot 3
BA16
SHEET 16 OF 26 SHEETS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LEGEND:
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NEW WIDE LINE
NEW DROP LANE LINE
NEW DOUBLE YELLOW CENTERLINE
EXISTING DOUBLE YELLOW CENTERLINE
NEW STOP LINE
EXISTING STOP LINE
NEW LANE EDGE LINE
EXISTING LANE EDGE LINE
NEW EDGE OF PAVEMENT
EXISTING PAVED EDGE
NEW LANE LINE
EXISTING LANE LINE
NEW CROSSWALK LINE
EXISTING CROSSWALK LINE
NEW CURB FACE
EXISTING CURB FACE
NEW TRAFFIC ARROW
EXISTING TRAFFIC ARROW
NEW CUT LINE
NEW FILL LINE
WETLAND BOUNDARY
WETLAND SYMBOL
ORDINARY HIGH WATER MARK
RIGHT OF WAY
CONSTRUCTION CENTERLINE
EXISTING DITCH
STREAM BUFFER
WETLAND BUFFER
RETAINING WALL
ECOLOGY EMBANKMENT
PERMANENT DIRECT WETLAND IMPACT
PERMANENT INDIRECT WETLAND IMPACT
PERMANENT WETLAND BUFFER IMPACT
TEMPORARY WETLAND IMPACT
TEMPORARY WETLAND BUFFER IMPACT
PERMANENT STREAM IMPACT
PERMANENT STREAM BUFFER IMPACT
TEMPORARY STREAM IMPACT
TEMPORARY STREAM BUFFER IMPACT
WETLAND 29E
WETLAND 30E
STREAM 8E
WETLAND 31E
SR 532 A LINE
445
450
OHW
MATCH LINE A 443+00 (SEE SHEET BA16)
MATCH LINE A 453+00 SEE SHEET BA18)
N
0 50 100
SCALE IN FEET
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REGIONAL ADM.
REVISION
DATE
BY
REGION NO. 10
STATE WASH
FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO.
LOCATION NO.
DATE
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otak Incorporated
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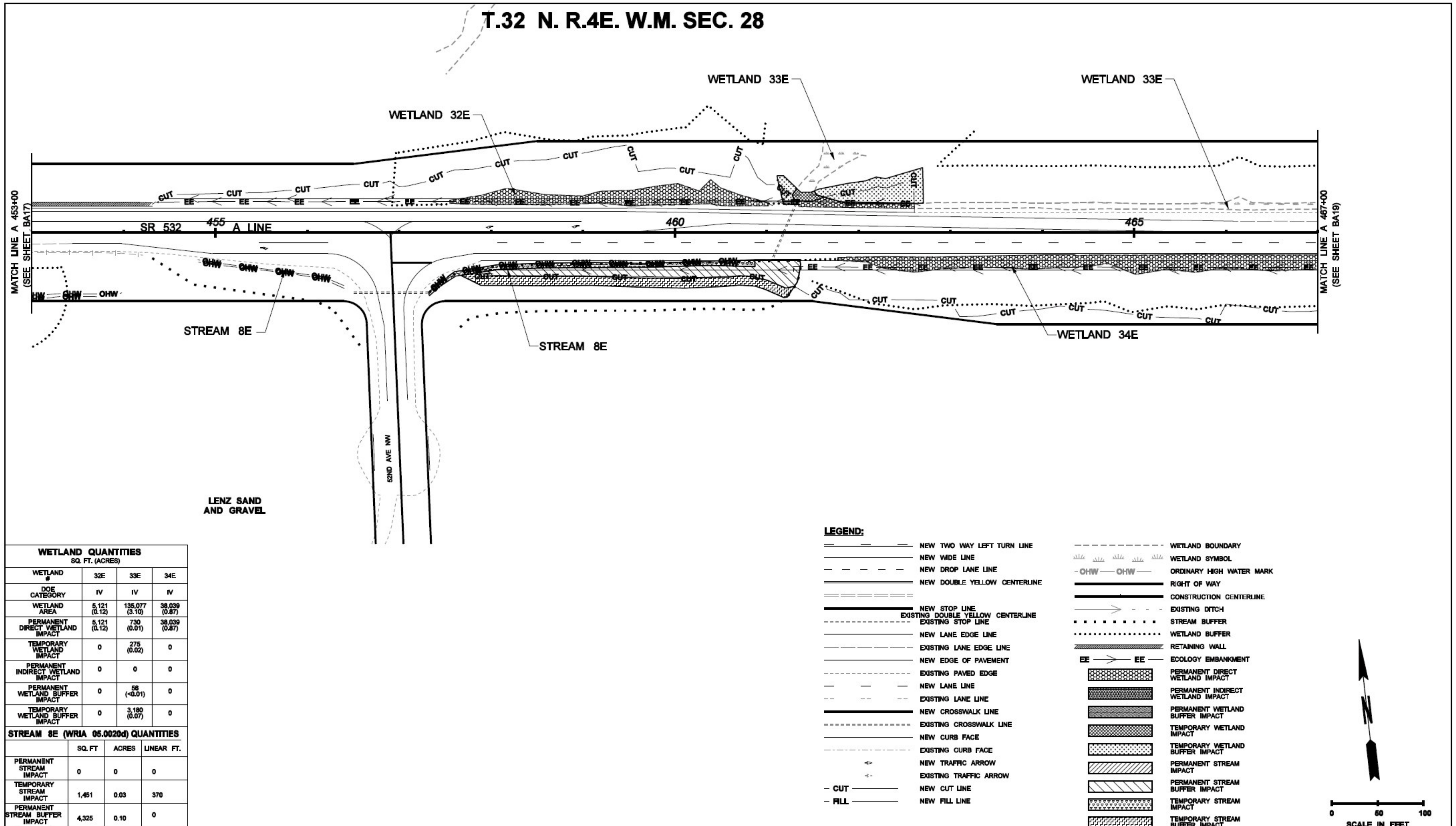
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW
BA SUPPORT
BA17
SHEET 17 OF 26 SHEETS



WETLAND QUANTITIES
SQ. FT. (ACRES)

WETLAND #	32E	33E	34E
DOE CATEGORY	IV	IV	IV
WETLAND AREA	5,121 (0.12)	135,077 (3.10)	38,039 (0.87)
PERMANENT DIRECT WETLAND IMPACT	5,121 (0.12)	730 (0.01)	38,039 (0.87)
TEMPORARY WETLAND IMPACT	0	275 (0.02)	0
PERMANENT INDIRECT WETLAND IMPACT	0	0	0
PERMANENT WETLAND BUFFER IMPACT	0	56 (<0.01)	0
TEMPORARY WETLAND BUFFER IMPACT	0	3,180 (0.07)	0

STREAM 8E (WRIA 05.0020d) QUANTITIES

	SQ. FT	ACRES	LINEAR FT.
PERMANENT STREAM IMPACT	0	0	0
TEMPORARY STREAM IMPACT	1,451	0.03	370
PERMANENT STREAM BUFFER IMPACT	4,325	0.10	0
TEMPORARY STREAM BUFFER IMPACT	3,583	0.08	0

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REVISION | DATE | BY

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JOB NUMBER

CONTRACT NO. | LOCATION NO.

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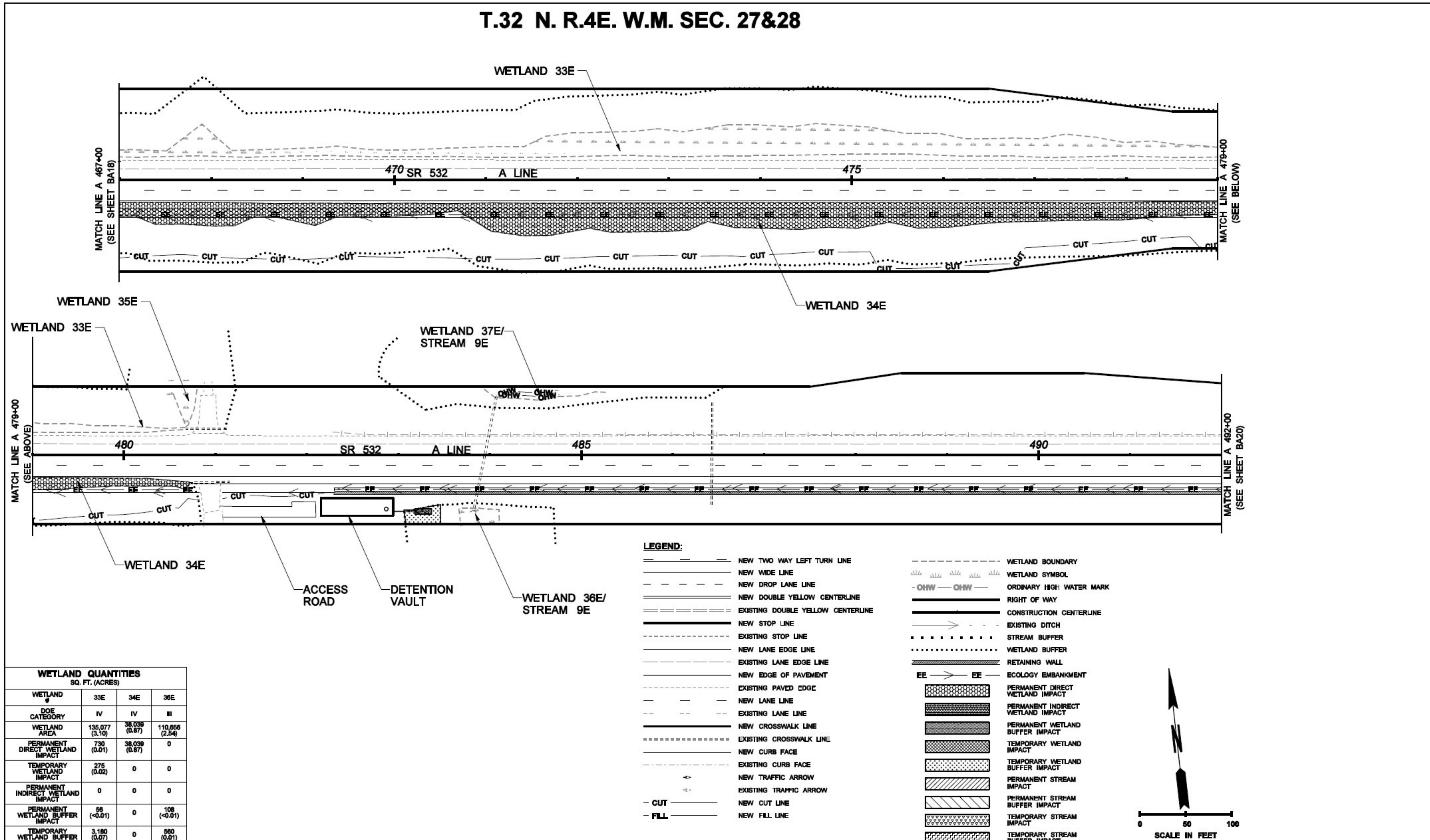
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

BA SUPPORT

Plot 5
BA18
SHEET 18 OF 26 SHEETS



WETLAND QUANTITIES
SQ. FT. (ACRES)

WETLAND #	33E	34E	36E
DOE CATEGORY	IV	IV	III
WETLAND AREA	135,077 (3.10)	38,039 (0.87)	110,656 (2.54)
PERMANENT DIRECT WETLAND IMPACT	730 (0.01)	38,039 (0.87)	0
TEMPORARY WETLAND IMPACT	275 (0.02)	0	0
PERMANENT INDIRECT WETLAND IMPACT	0	0	0
PERMANENT WETLAND BUFFER IMPACT	56 (<0.01)	0	106 (<0.01)
TEMPORARY WETLAND BUFFER IMPACT	3,160 (0.07)	0	560 (0.01)

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JOB NUMBER
CONTRACT NO. | LOCATION NO.

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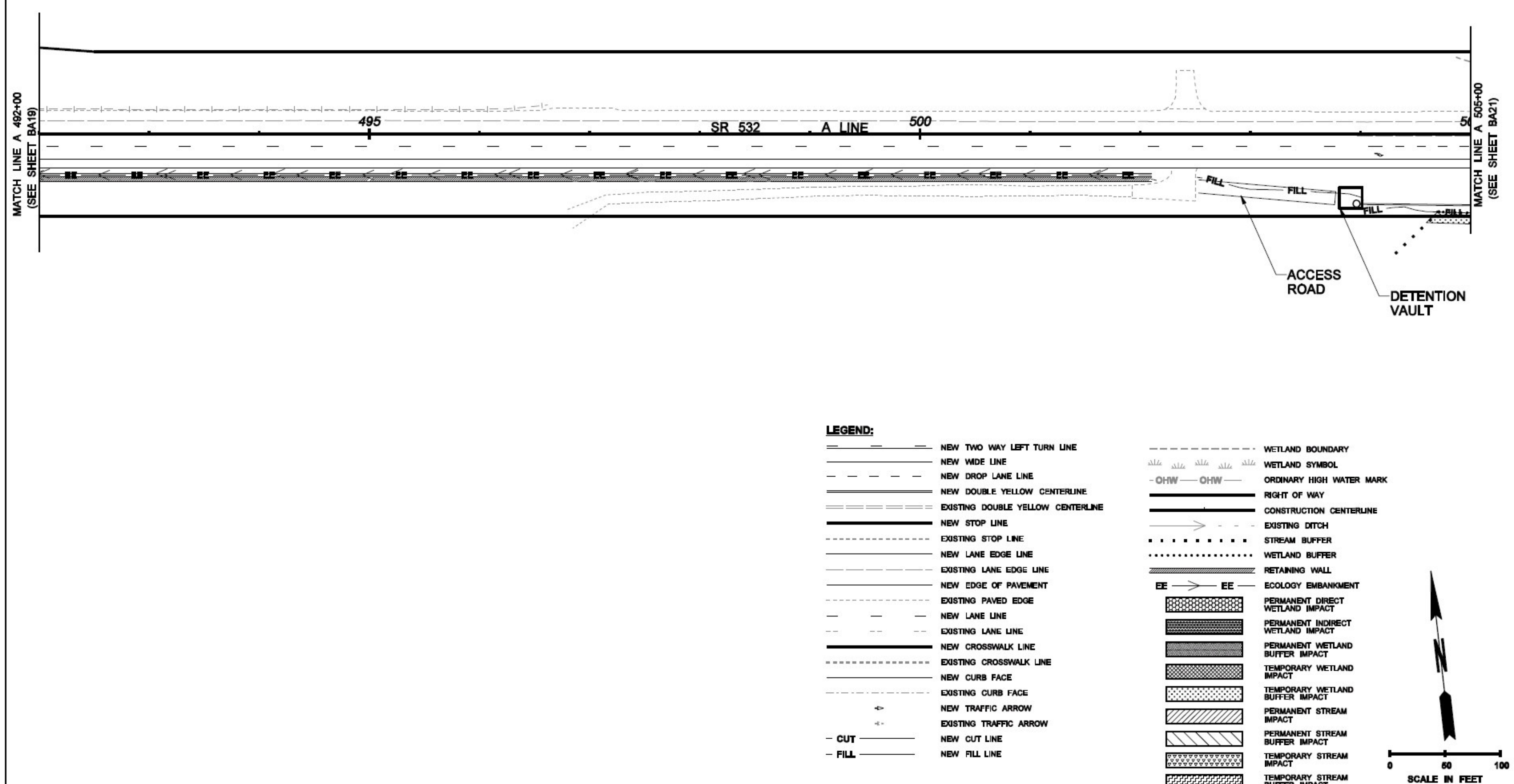
Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

BA SUPPORT

Plot 6
BA19
SHEET 19 OF 26 SHEETS

T.32 N. R.4E. W.M. SEC. 27



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DESIGNED BY	J. ANDREWS
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PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

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JOB NUMBER

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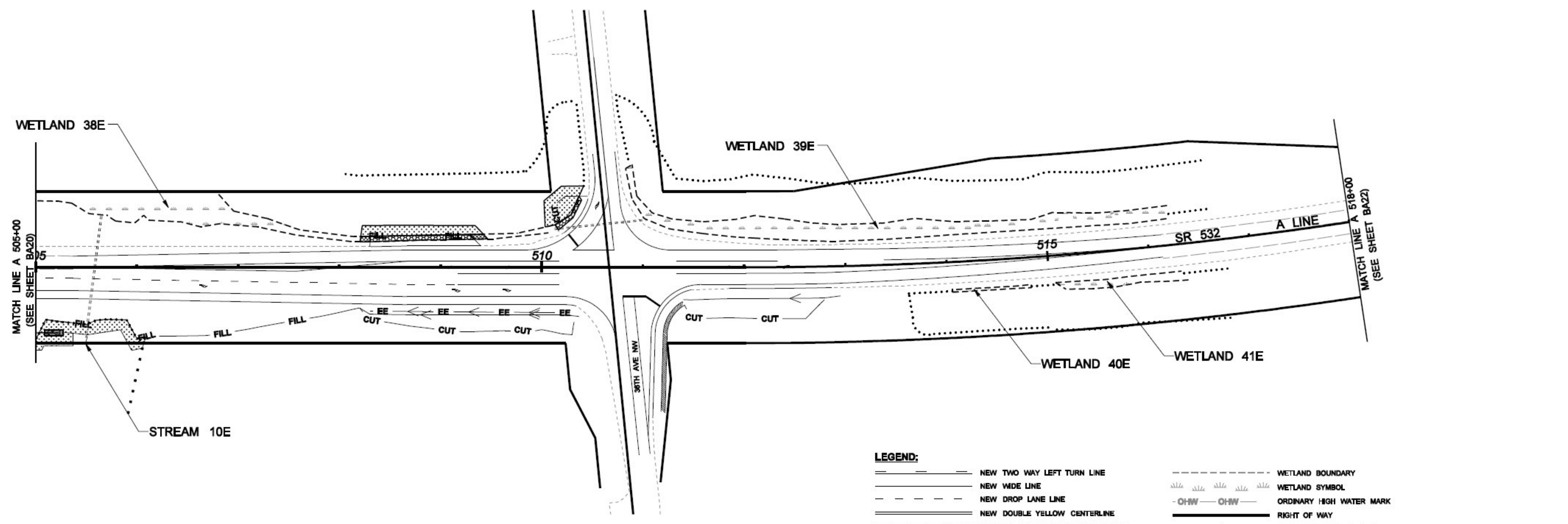
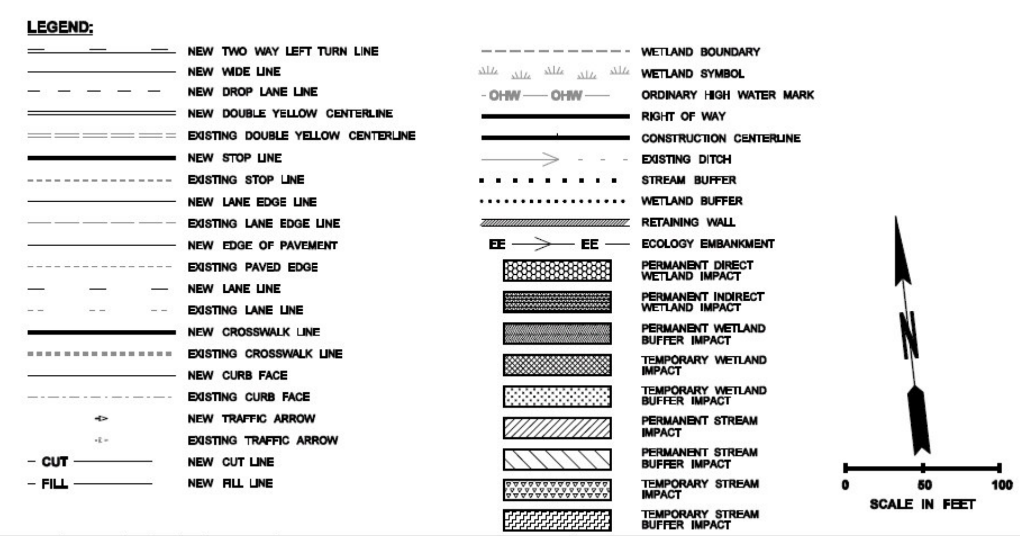
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

BA SUPPORT

Plot 7
BA20
SHEET 20 OF 26 SHEETS

T.32 N. R.4E. W.M. SEC. 27





WETLAND QUANTITIES SQ. FT. (ACRES)	
WETLAND #	38E
DOE CATEGORY	III
WETLAND AREA	91,475 (2.10)
PERMANENT DIRECT WETLAND IMPACT	643 (0.01)
TEMPORARY WETLAND IMPACT	115 (<0.01)
PERMANENT INDIRECT WETLAND IMPACT	0
PERMANENT WETLAND BUFFER IMPACT	0
TEMPORARY WETLAND BUFFER IMPACT	2,133 (0.05)

STREAM 10E QUANTITIES	SQ. FT	ACRES	LINEAR FT.
PERMANENT STREAM IMPACT	0	0	0
TEMPORARY STREAM IMPACT	0	0	0
PERMANENT STREAM BUFFER IMPACT	108	<0.01	0
TEMPORARY STREAM BUFFER IMPACT	1,975	0.05	0

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10	WASH	
JOB NUMBER		
CONTRACT NO.		LOCATION NO.

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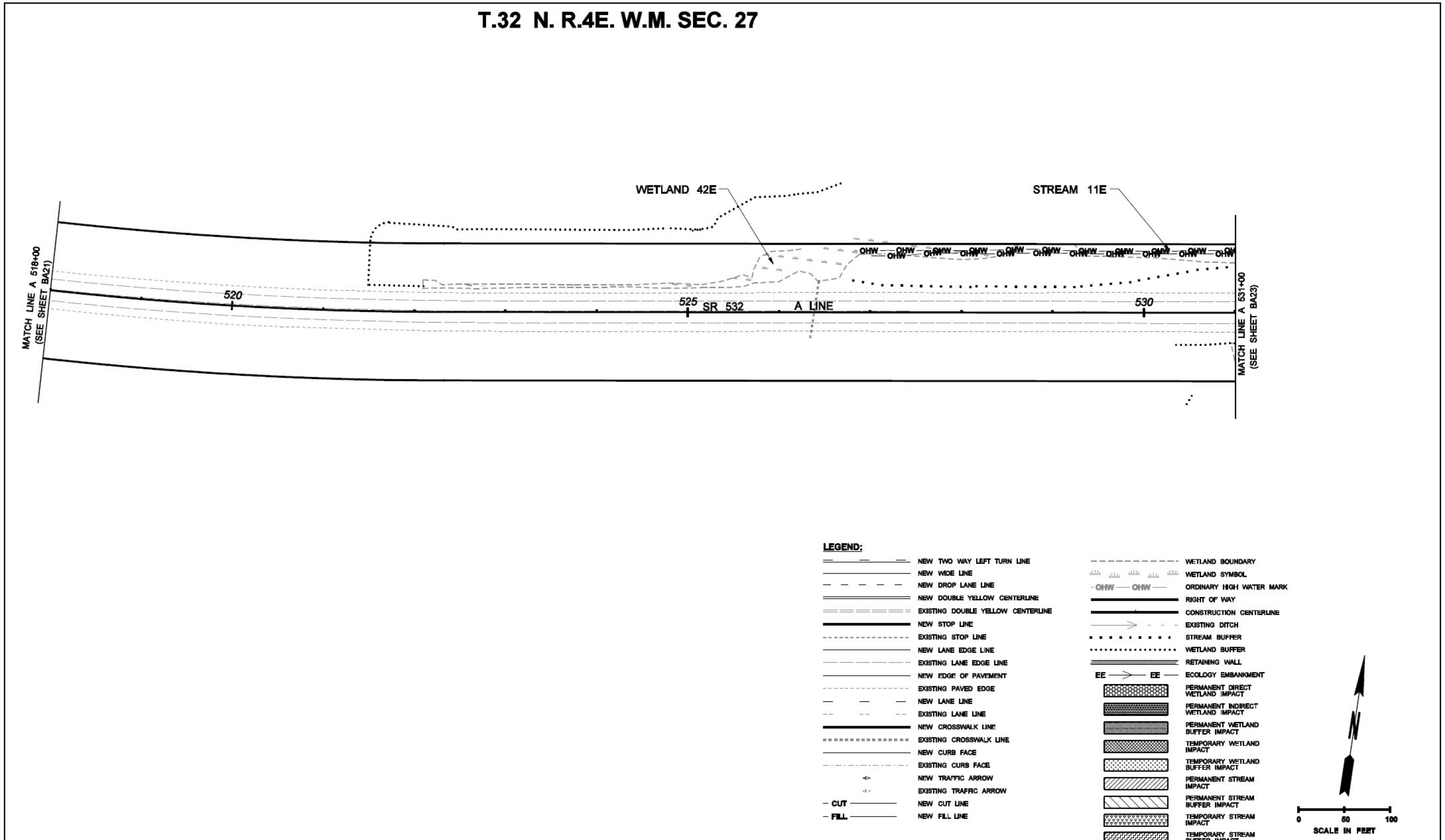
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW
BA SUPPORT

Plot 8
BA21
SHEET 21 OF 26 SHEETS



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DESIGNED BY	J. ANDREWS			
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PROJ. ENGR.				
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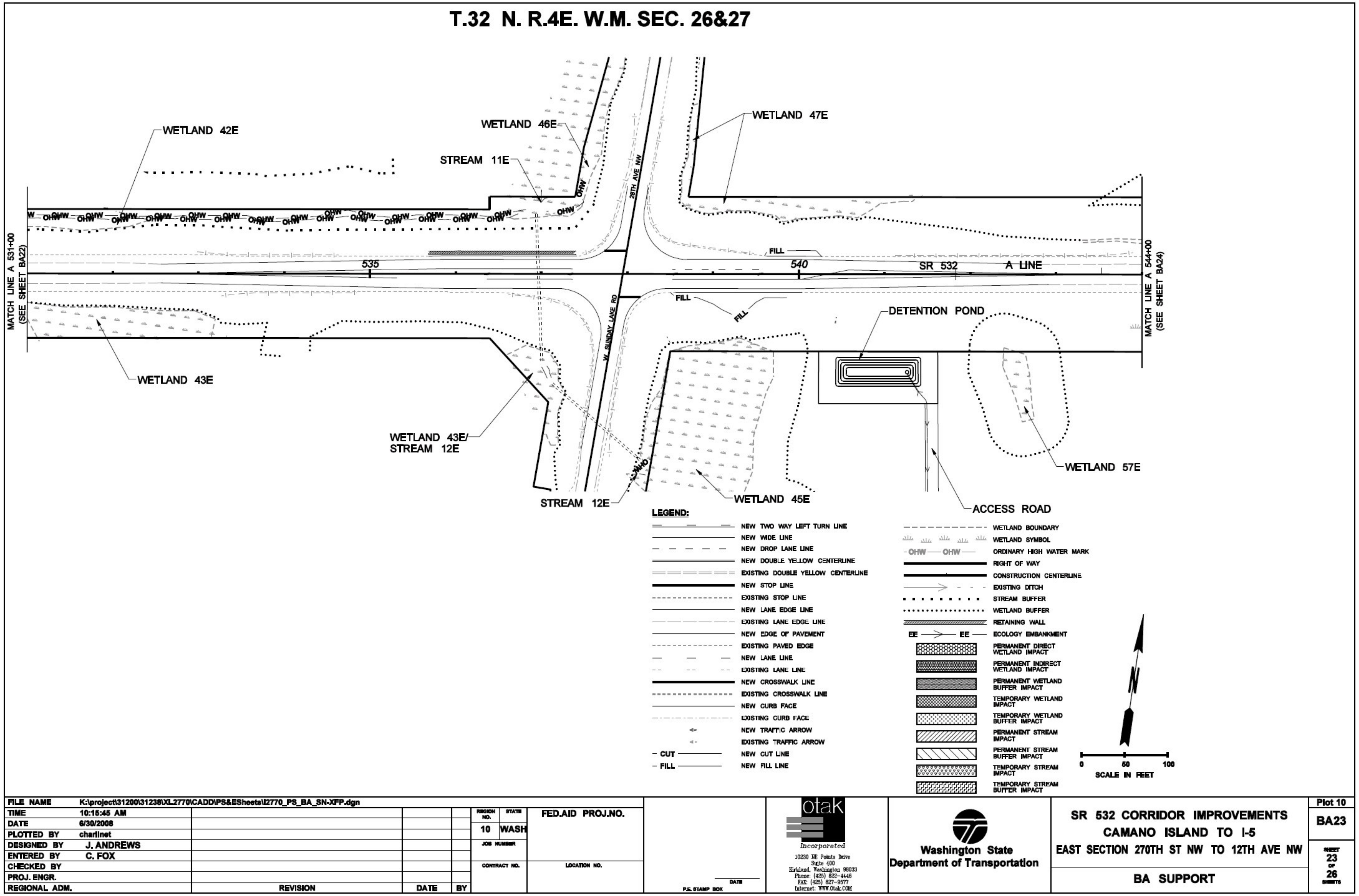
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

BA SUPPORT

Plot 9

BA22

SHEET 22 OF 26 SHEETS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WETLAND 42E
WETLAND 46E
STREAM 11E
WETLAND 47E
28TH AVE NW
W. SUNDAY LAKE RD
MATCH LINE A 531+00 (SEE SHEET BA22)
MATCH LINE A 544+00 (SEE SHEET BA24)
535
540
SR 532 A LINE
FILL
DETENTION POND
WETLAND 43E
WETLAND 43E/ STREAM 12E
STREAM 12E
WETLAND 45E
WETLAND 57E
ACCESS ROAD
LEGEND:
NEW TWO WAY LEFT TURN LINE
NEW WIDE LINE
NEW DROP LANE LINE
NEW DOUBLE YELLOW CENTERLINE
EXISTING DOUBLE YELLOW CENTERLINE
NEW STOP LINE
EXISTING STOP LINE
NEW LANE EDGE LINE
EXISTING LANE EDGE LINE
NEW EDGE OF PAVEMENT
EXISTING PAVED EDGE
NEW LANE LINE
EXISTING LANE LINE
NEW CROSSWALK LINE
EXISTING CROSSWALK LINE
NEW CURB FACE
EXISTING CURB FACE
NEW TRAFFIC ARROW
EXISTING TRAFFIC ARROW
CUT — NEW CUT LINE
FILL — NEW FILL LINE
WETLAND BOUNDARY
WETLAND SYMBOL
OHW — OHW — ORDINARY HIGH WATER MARK
RIGHT OF WAY
CONSTRUCTION CENTERLINE
EXISTING DITCH
STREAM BUFFER
WETLAND BUFFER
RETAINING WALL
EE — EE — ECOLOGY EMBANKMENT
PERMANENT DIRECT WETLAND IMPACT
PERMANENT INDIRECT WETLAND IMPACT
PERMANENT WETLAND BUFFER IMPACT
TEMPORARY WETLAND IMPACT
TEMPORARY WETLAND BUFFER IMPACT
PERMANENT STREAM IMPACT
PERMANENT STREAM BUFFER IMPACT
TEMPORARY STREAM IMPACT
TEMPORARY STREAM BUFFER IMPACT
N
0 50 100
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DATE 6/30/2008
PLOTTED BY charlinet
DESIGNED BY J. ANDREWS
ENTERED BY C. FOX
CHECKED BY
PROJ. ENGR.
REGIONAL ADM.
REVISION
DATE
BY
REGION NO. 10
STATE WASH
FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO.
LOCATION NO.
DATE
P.E. STAMP BOX
otak Incorporated
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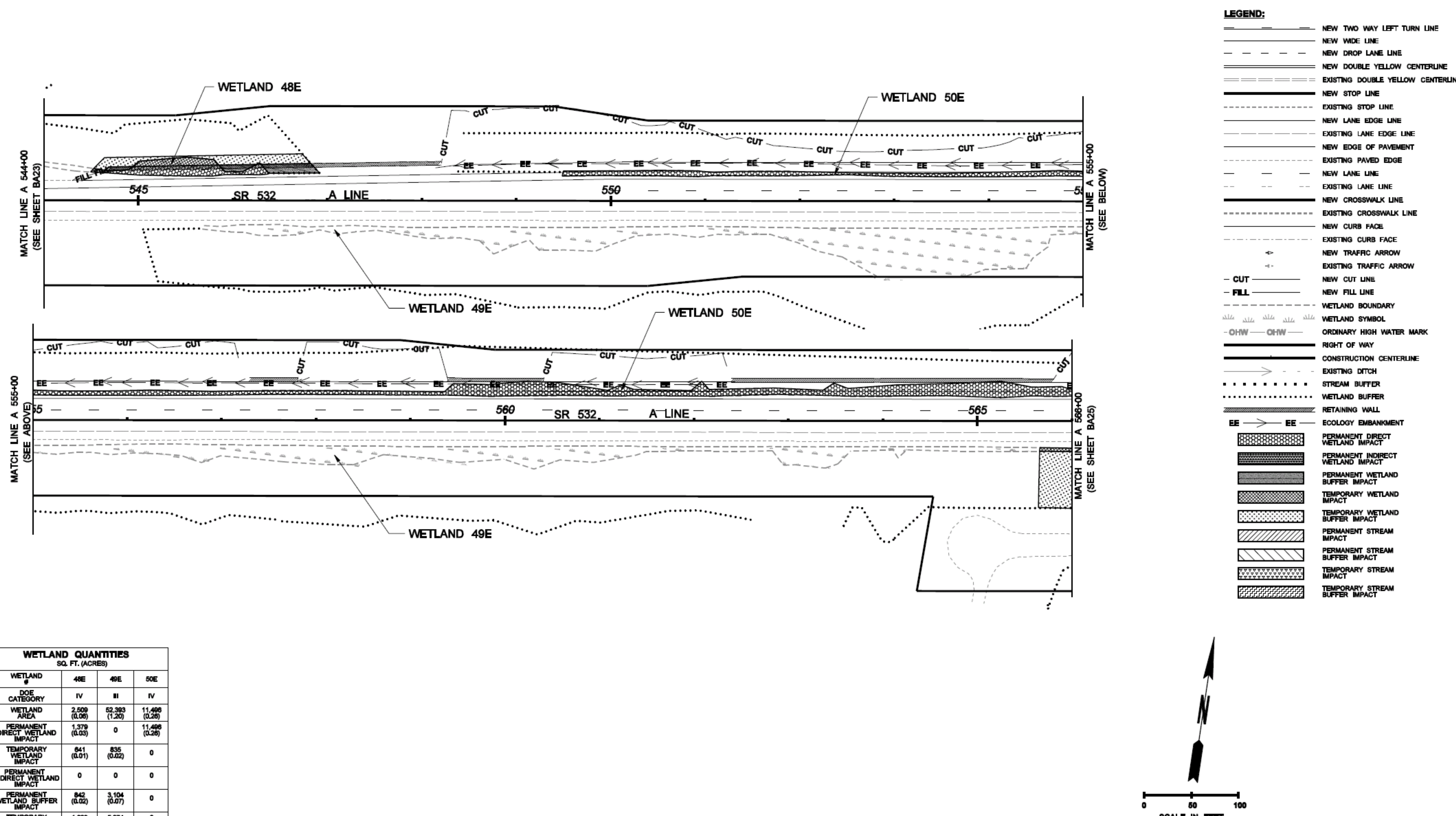
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW
BA SUPPORT
Plot 10
BA23
SHEET 23 OF 26 SHEETS

T.32 N. R.4E. W.M. SEC. 26



WETLAND QUANTITIES SQ. FT. (ACRES)			
WETLAND #	48E	49E	50E
DOE CATEGORY	IV	III	IV
WETLAND AREA	2,509 (0.06)	52,393 (1.20)	11,496 (0.26)
PERMANENT DIRECT WETLAND IMPACT	1,379 (0.03)	0	11,496 (0.26)
TEMPORARY WETLAND IMPACT	641 (0.01)	835 (0.02)	0
PERMANENT INDIRECT WETLAND IMPACT	0	0	0
PERMANENT WETLAND BUFFER IMPACT	842 (0.02)	3,104 (0.07)	0
TEMPORARY WETLAND BUFFER IMPACT	1,629 (0.04)	5,274 (0.12)	0

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REVISION | DATE | BY

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SR532

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SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

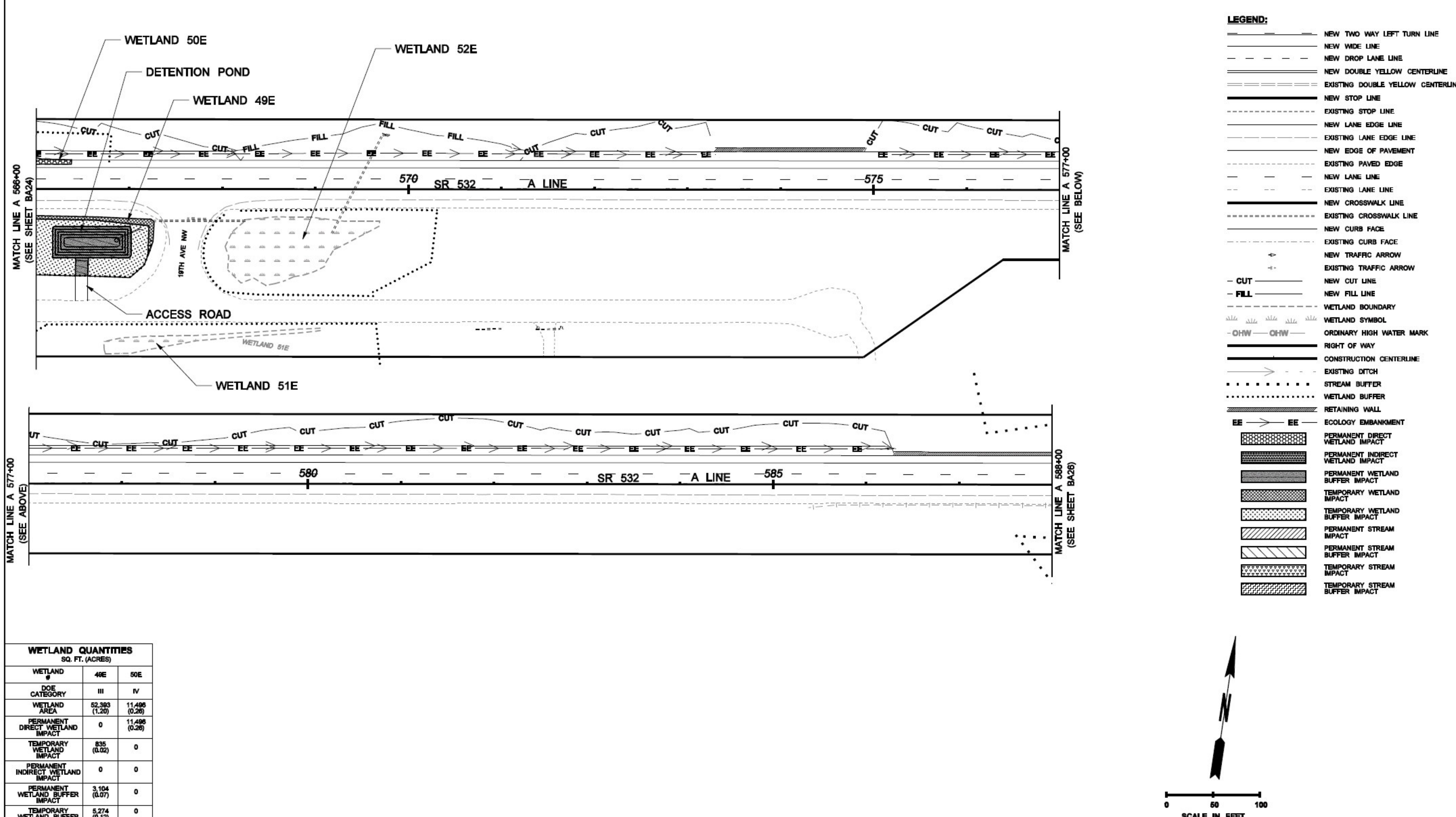
BA SUPPORT

Plot 11

BA24

SHEET 24 OF 26 SHEETS

T.32 N. R.4E. W.M. SEC. 26



WETLAND QUANTITIES
SQ. FT. (ACRES)

WETLAND #	49E	50E
DOE CATEGORY	III	IV
WETLAND AREA	52,393 (1.20)	11,496 (0.26)
PERMANENT DIRECT WETLAND IMPACT	0	11,496 (0.26)
TEMPORARY WETLAND IMPACT	835 (0.02)	0
PERMANENT INDIRECT WETLAND IMPACT	0	0
PERMANENT WETLAND BUFFER IMPACT	3,104 (0.07)	0
TEMPORARY WETLAND BUFFER IMPACT	5,274 (0.12)	0

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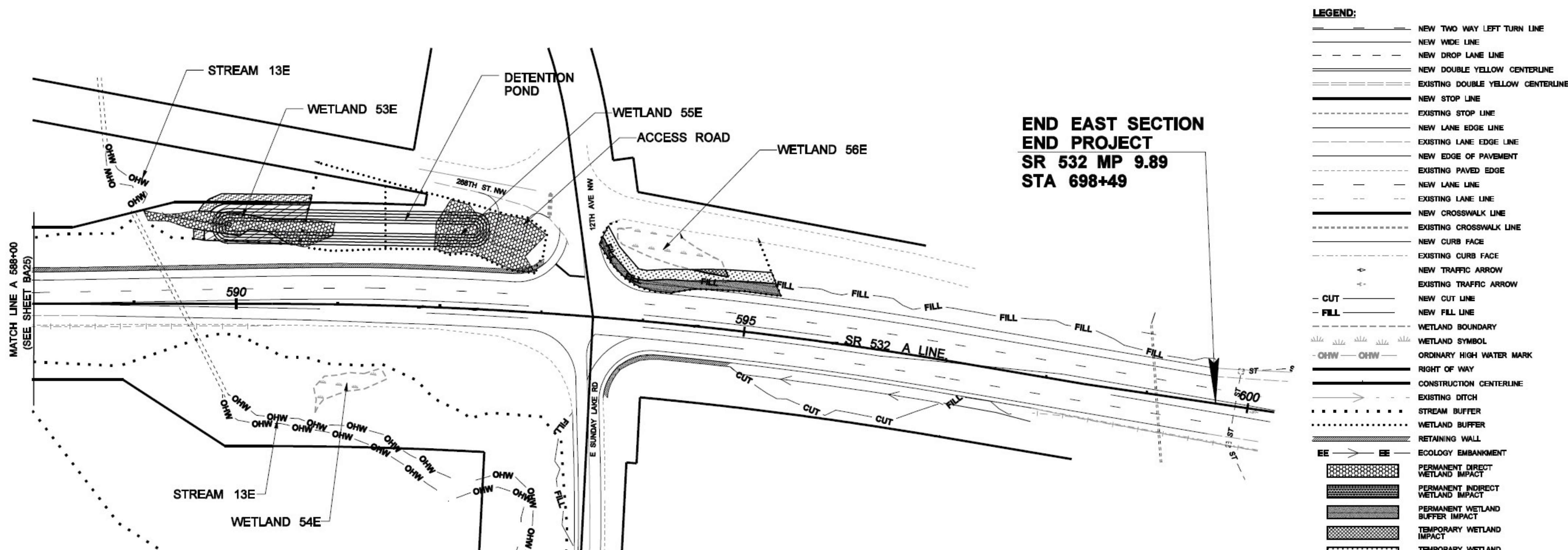
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

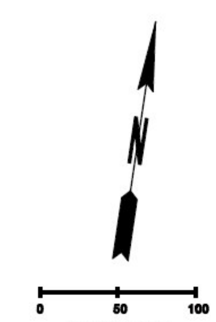
BA SUPPORT

BA25

SHEET 25 OF 26 SHEETS

T.32 N. R.4E. W.M. SEC. 25&26





STREAM 13E (WRIA 05-0065) QUANTITIES

	SQ. FT	ACRES	LINEAR FT.
PERMANENT STREAM IMPACT	0	0	0
TEMPORARY STREAM IMPACT	0	0	0
PERMANENT STREAM BUFFER IMPACT	1,775	0.04	0
TEMPORARY STREAM BUFFER IMPACT	1,180	0.03	0

WETLAND QUANTITIES
SQ. FT. (ACRES)

WETLAND #	53E	55E	56E
DOE CATEGORY	III	III	IV
WETLAND AREA	3,104 (0.07)	4,556 (0.10)	4,356 (0.10)
PERMANENT DIRECT WETLAND IMPACT	3,104 (0.07)	4,556 (0.10)	0
TEMPORARY WETLAND IMPACT	0	0	140 (<0.01)
PERMANENT INDIRECT WETLAND IMPACT	0	0	0
PERMANENT WETLAND BUFFER IMPACT	0	0	1,673 (0.04)
TEMPORARY WETLAND BUFFER IMPACT	0	0	1,843 (0.04)

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SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

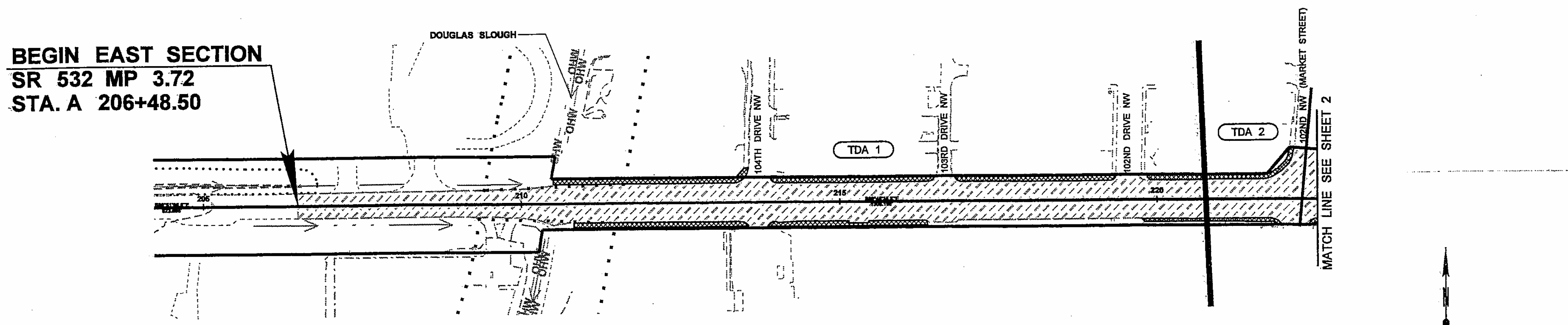
BA SUPPORT

Plot 13

BA26

SHEET 26 OF 26 SHEETS

APPENDIX C: SR 532 TDA PLAN SHEETS

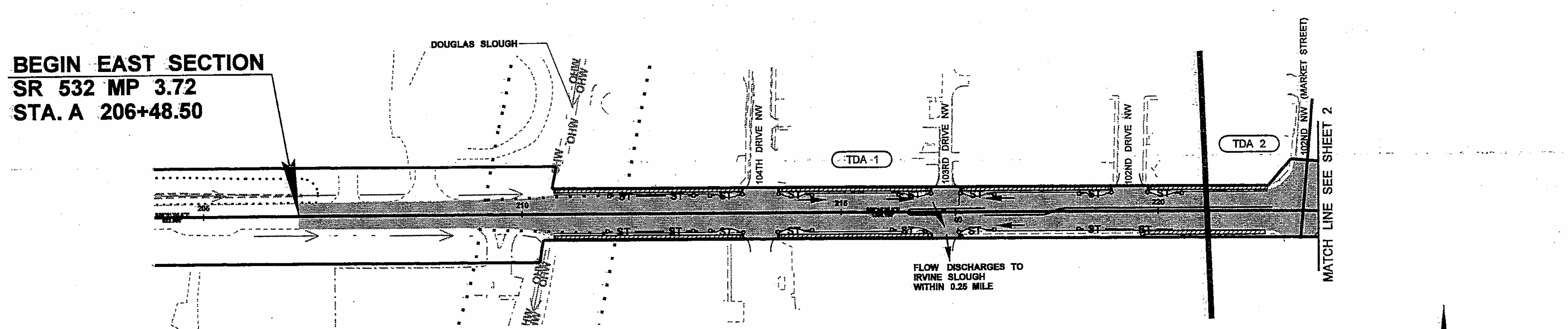


EXISTING AREA TABLE	
EXISTING	TDA 1 (SQ FT)
PERVIOUS SURFACE	50,105
IMPERVIOUS SURFACE	
POLLUTION GENERATING	91,583
NON-POLLUTION GENERATING	0
TOTAL	91,583
TOTAL R/W SURFACE AREA	141,688

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE



PROPOSED AREA TABLE	
PROPOSED	TDA 1 (SQ FT)
PERVIOUS SURFACE	50,105
IMPERVIOUS SURFACE	
POLLUTION GENERATING	91,583
NON-POLLUTION GENERATING	0
TOTAL	91,583
TOTAL R/W SURFACE AREA	141,688
NEW IMPERVIOUS SURFACE	0

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
- OHW — OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- EE — EE — ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

FILE NAME	P:\Clients\1631-WSDOT\554-1631-070 SR 532 Corridor Y-10222\Phase AB - SR 532 DB\CADD\DWG\L2770_ps_SF.dgn
TIME	2:02:41 PM
DATE	6/19/2008
PLOTTED BY	burrumar
DESIGNED BY	P. MORAN
ENTERED BY	B. PURGANAN
CHECKED BY	S. LOTT
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

JOB NUMBER XL2770

CONTRACT NO. | LOCATION NO.

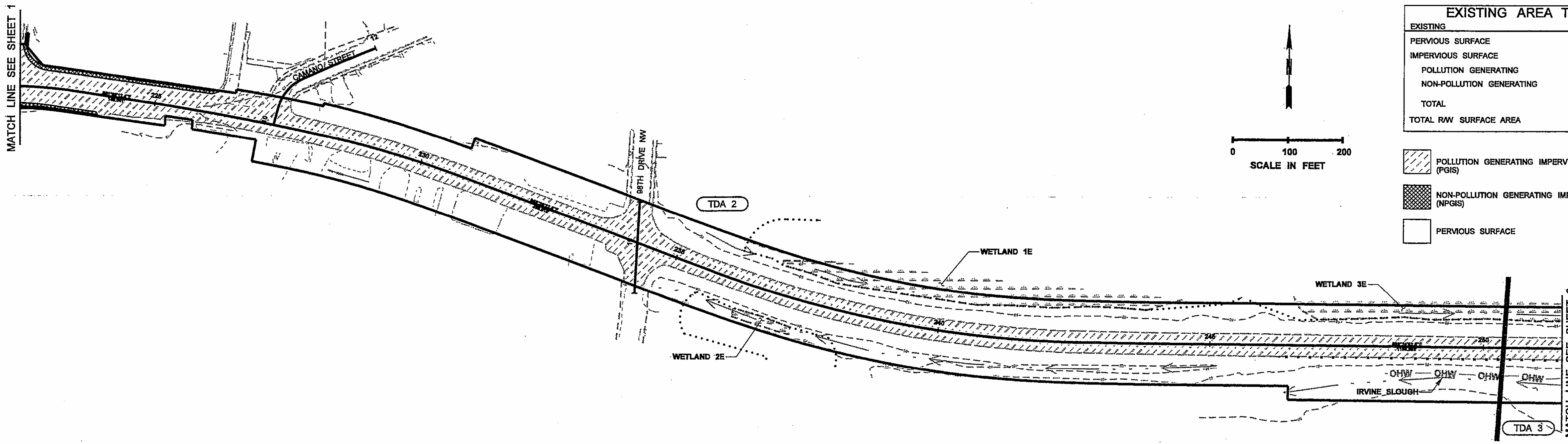
P.E. STAMP BOX DATE | P.E. STAMP BOX DATE

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 1 DELINEATION

Plot 1
SD1
SHEET 1 OF 19 SHEETS

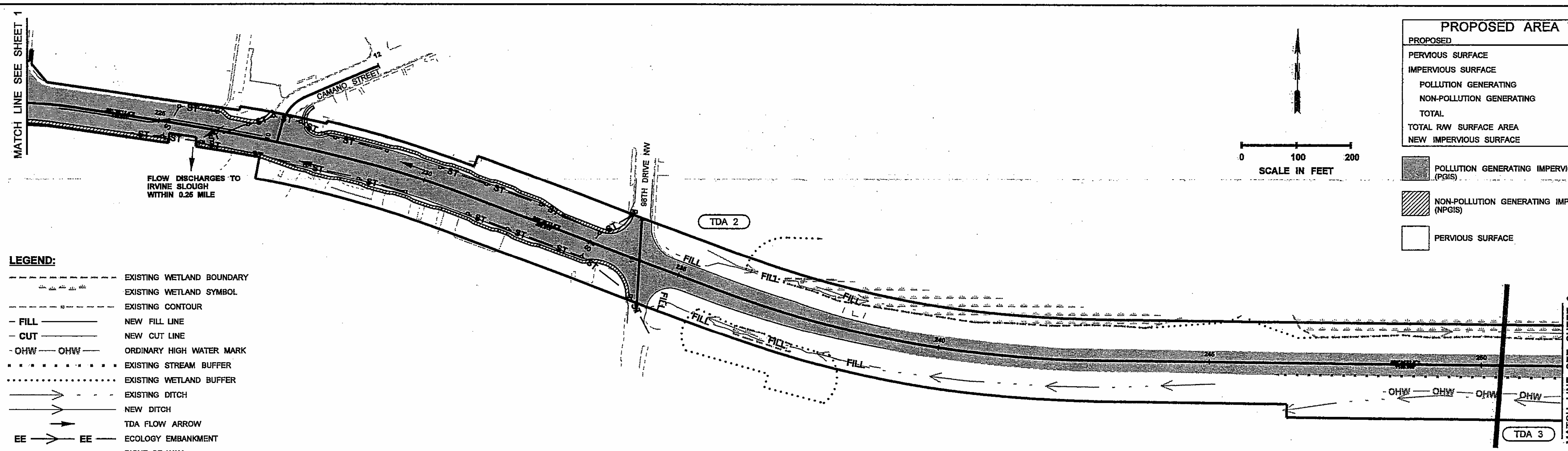


EXISTING AREA TABLE	
EXISTING	TDA 2 (SQ FT)
PERVIOUS SURFACE	255,564
IMPERVIOUS SURFACE	
POLLUTION GENERATING	148,829
NON-POLLUTION GENERATING	0
TOTAL	148,829
TOTAL R/W SURFACE AREA	404,393

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE



PROPOSED AREA TABLE	
PROPOSED	TDA 2 (SQ FT)
PERVIOUS SURFACE	230,711
IMPERVIOUS SURFACE	
POLLUTION GENERATING	173,682
NON-POLLUTION GENERATING	0
TOTAL	173,682
TOTAL R/W SURFACE AREA	404,393
NEW IMPERVIOUS SURFACE	24,853

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
- OHW — OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- EE — EE — ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

FILE NAME	P:\Clients\1631-WSDOT\554-1631-070 SR 532 Corridor Y-10222\Phase AB - SR 532 DB\CADD\DWG\L2770_ps_SF.dgn			
TIME	2:02:42 PM			
DATE	6/19/2008			
PLOTTED BY	burrumar			
DESIGNED BY	P. MORAN			
ENTERED BY	B. PURGANAN			
CHECKED BY	S. LOTT			
PROJ. ENGR.				
REGIONAL ADM.		REVISION	DATE	BY

REGION NO.	STATE	FED.AID PROJ.NO.
10	WASH	
JOB NUMBER XL2770		
CONTRACT NO.		LOCATION NO.

P.E. STAMP BOX DATE

P.E. STAMP BOX DATE

Washington State Department of Transportation

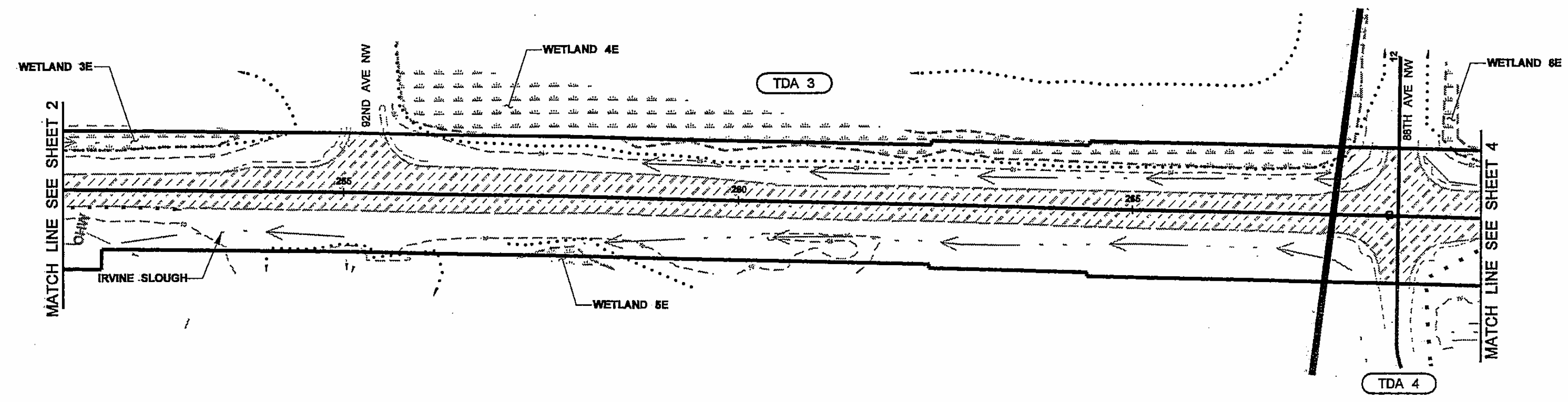
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 2 DELINEATION

Plot 2

SD2

SHEET 2 OF 19 SHEETS



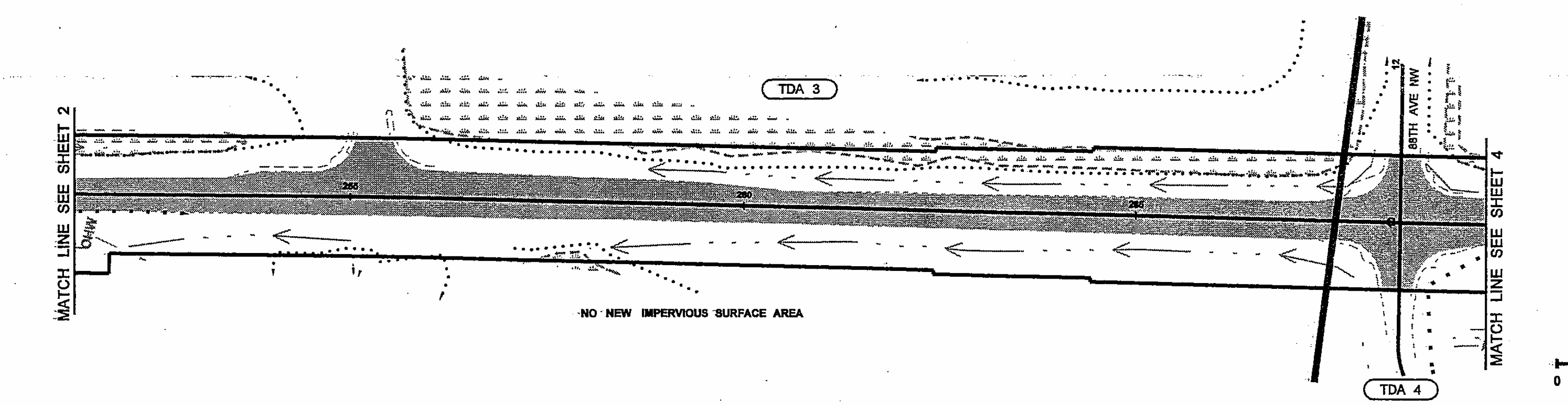
EXISTING AREA TABLE	
EXISTING	TDA 3 (SQ FT)
PERVIOUS SURFACE	186,133
IMPERVIOUS SURFACE	
POLLUTION GENERATING	83,962
NON-POLLUTION GENERATING	0
TOTAL	83,962
TOTAL R/W SURFACE AREA	270,095

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

0 100 200
SCALE IN FEET



PROPOSED AREA TABLE	
PROPOSED	TDA 3 (SQ FT)
PERVIOUS SURFACE	186,133
IMPERVIOUS SURFACE	
POLLUTION GENERATING	83,962
NON-POLLUTION GENERATING	0
TOTAL	83,962
TOTAL R/W SURFACE AREA	270,095
NEW IMPERVIOUS SURFACE	0

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

0 100 200
SCALE IN FEET

LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
- OHW — OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- EE — EE — ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

FILE NAME	P:\Clients\1631-WSDOT\554-1631-070 SR 532 Corridor Y-10222\Phase AB - SR 532 DB\CADD\DWG\L2770_ps_SF.dgn
TIME	2:02:43 PM
DATE	6/19/2008
PLOTTED BY	burrumar
DESIGNED BY	P. MORAN
ENTERED BY	B. PURGANAN
CHECKED BY	S. LOTT
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

JOB NUMBER XL2770

CONTRACT NO. | LOCATION NO.

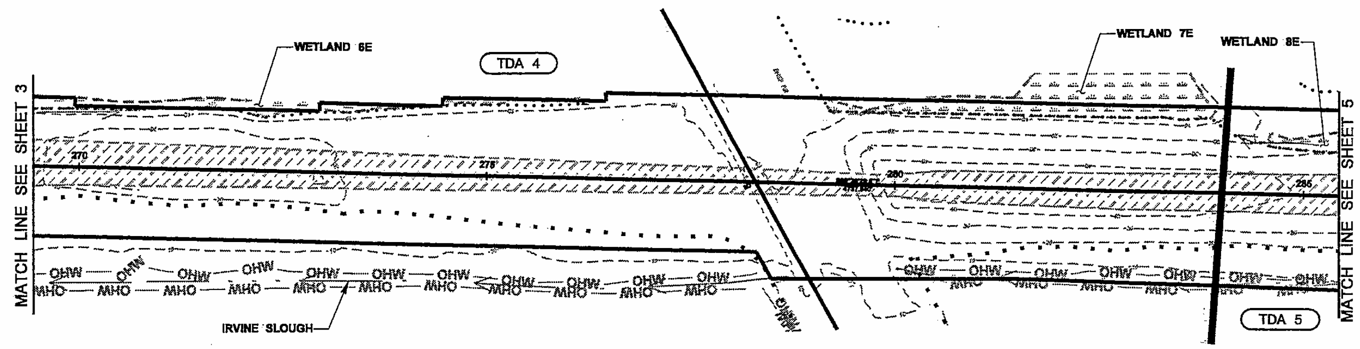
P.E. STAMP BOX DATE | P.E. STAMP BOX DATE

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 3 DELINEATION

Plot 3 | SD3 | SHEET 3 OF 19 SHEETS



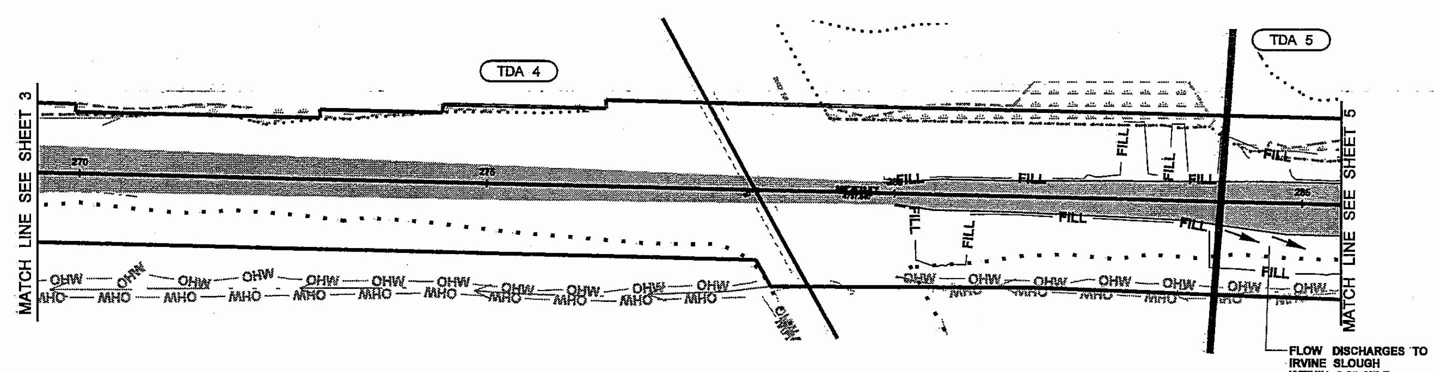
EXISTING AREA TABLE	
EXISTING	TDA 4 (SQ FT)
PERVIOUS SURFACE	232,767
IMPERVIOUS SURFACE	
POLLUTION GENERATING	76,888
NON-POLLUTION GENERATING	0
TOTAL	76,888
TOTAL R/W SURFACE AREA	309,655

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

0 100 200
SCALE IN FEET



0 100 200
SCALE IN FEET

PROPOSED AREA TABLE	
PROPOSED	TDA 4 (SQ FT)
PERVIOUS SURFACE	231,009
IMPERVIOUS SURFACE	
POLLUTION GENERATING	78,646
NON-POLLUTION GENERATING	0
TOTAL	78,646
TOTAL R/W SURFACE AREA	309,655
NEW IMPERVIOUS SURFACE	1,758

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
- OHW — OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- EE — EE — ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

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TIME	2:02:44 PM			
DATE	6/19/2008			
PLOTTED BY	burrumar			
DESIGNED BY	P. MORAN			
ENTERED BY	B. PURGANAN			
CHECKED BY	S. LOTT			
PROJ. ENGR.				
REGIONAL ADM.		REVISION	DATE	BY

REGION NO.	STATE	FED.AID PROJ.NO.
10	WASH	
JOB NUMBER		
XL2770		
CONTRACT NO.		LOCATION NO.

P.E. STAMP BOX DATE

P.E. STAMP BOX DATE

Washington State
Department of Transportation

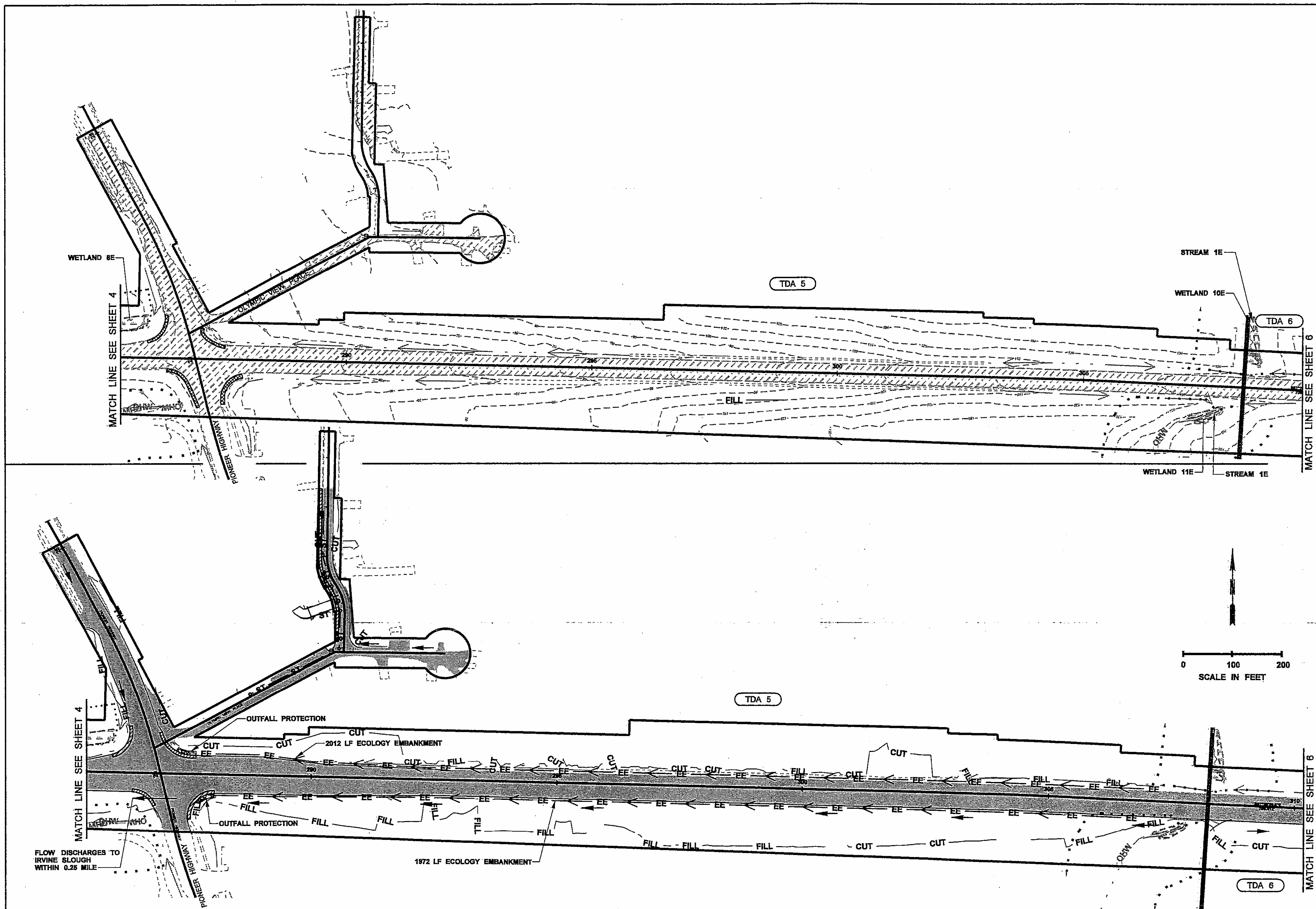
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 4 DELINEATION

Plot 4

SD4

SHEET 4 OF 19 SHEETS



EXISTING AREA TABLE

EXISTING	TDA 5 (SQ FT)
PERVIOUS SURFACE	497,275
IMPERVIOUS SURFACE	
POLLUTION GENERATING	151,669
NON-POLLUTION GENERATING	0
TOTAL	151,669
TOTAL R/W SURFACE AREA	648,944

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

0 100 200
SCALE IN FEET

PROPOSED AREA TABLE

PROPOSED	TDA 5 (SQ FT)
PERVIOUS SURFACE	454,267
IMPERVIOUS SURFACE	
POLLUTION GENERATING	194,677
NON-POLLUTION GENERATING	0
TOTAL	194,677
TOTAL R/W SURFACE AREA	648,944
NEW IMPERVIOUS SURFACE	43,008

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

0 100 200
SCALE IN FEET

LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
- OHW — OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- EE — EE — ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

FILE NAME	P:\Clients\1631-WSDOT\554-1631-070 SR 532 Corridor Y-10222\Phase AB - SR 532 DB\CADD\DWG\L2770_ps_SF.dgn
TIME	2:02:46 PM
DATE	6/19/2008
PLOTTED BY	burrumar
DESIGNED BY	P. MORAN
ENTERED BY	B. PURGANAN
CHECKED BY	S. LOTT
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.
JOB NUMBER XL2770
CONTRACT NO. | LOCATION NO.

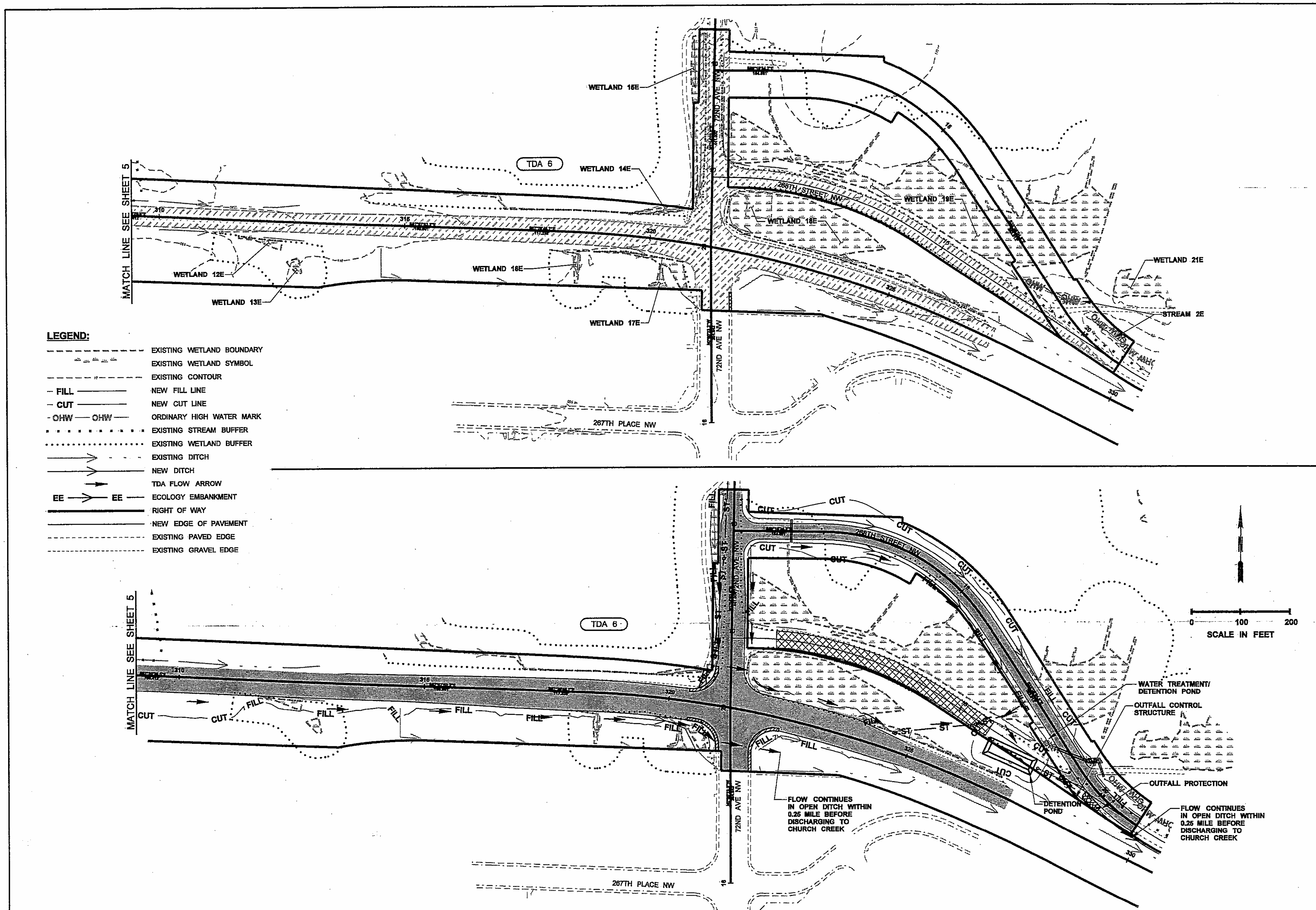
P.E. STAMP BOX DATE | P.E. STAMP BOX DATE

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 5 DELINEATION

Plot 5
SD5
SHEET 5 OF 19 SHEETS



EXISTING AREA TABLE

EXISTING	TDA 6 (SQ FT)
PERVIOUS SURFACE	346,307
IMPERVIOUS SURFACE	
POLLUTION GENERATING	149,497
NON-POLLUTION GENERATING	0
TOTAL	149,497
TOTAL R/W SURFACE AREA	495,804

PROPOSED AREA TABLE

PROPOSED	TDA 6 (SQ FT)
PERVIOUS SURFACE	323,950
REMOVED IMPERVIOUS SURFCE	15,765
IMPERVIOUS SURFACE	
POLLUTION GENERATING	171,854
NON-POLLUTION GENERATING	0
TOTAL	171,854
TOTAL R/W SURFACE AREA	495,804
NEW IMPERVIOUS SURFACE	22,357

FILE NAME	P:\Clients\1631-WSDOT\554-1631-070 SR 532 Corridor Y-10222\Phase AB - SR 532 DB\CADD\DWG\L2770_ps_SF.dgn
TIME	2:02:47 PM
DATE	6/19/2008
PLOTTED BY	burrumar
DESIGNED BY	P. MORAN
ENTERED BY	B. PURGANAN
CHECKED BY	S. LOTT
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

JOB NUMBER XL2770

CONTRACT NO. | LOCATION NO.

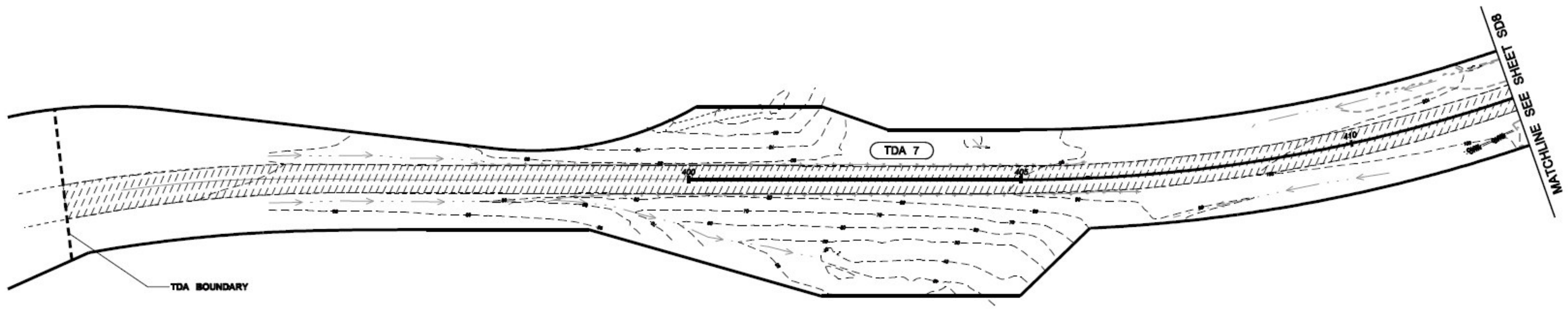
P.E. STAMP BOX DATE | P.E. STAMP BOX DATE

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 6 DELINEATION

Plot 6
SD6
SHEET 6 OF 19 SHEETS



0 100 200
SCALE IN FEET

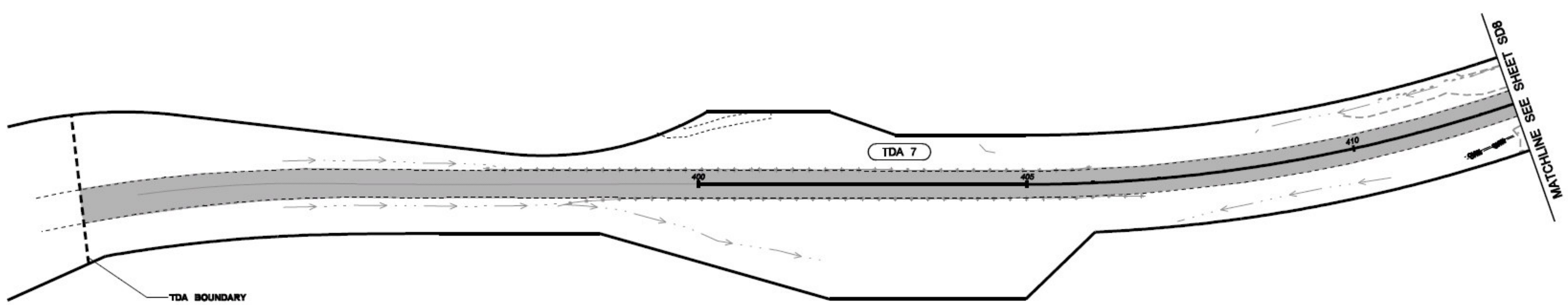
EXISTING AREA TABLE

EXISTING	TDA 7 (SQ FT)
PERVIOUS SURFACE	348,588
IMPERVIOUS SURFACE	
POLLUTION GENERATING	119,654
NON-POLLUTION GENERATING	0
TOTAL	119,654
TOTAL R/W SURFACE AREA	468,242

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE



0 100 200
SCALE IN FEET

PROPOSED AREA TABLE

PROPOSED	TDA 7 (SQ FT)
PERVIOUS SURFACE	348,540
IMPERVIOUS SURFACE	
POLLUTION GENERATING	119,702
NON-POLLUTION GENERATING	0
TOTAL	119,702
TOTAL R/W SURFACE AREA	468,242
NEW IMPERVIOUS SURFACE	48

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
- OHW — OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

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DATE	6/20/2008			
PLOTTED BY	charlinet			
DESIGNED BY	J. ANDREWS			
ENTERED BY	C. FOX			
CHECKED BY				
PROJ. ENGR.				
REGIONAL ADM.		REVISION	DATE	BY

REGION NO.	STATE	FED.AID PROJ.NO.
10	WASH	
JOB NUMBER		
CONTRACT NO.		LOCATION NO.

DATE

P.E. STAMP BOX

otak Incorporated
10230 NE Points Drive
Suite 400
Kirkland, Washington 98033
Phone: (425) 822-4446
FAX: (425) 827-9577
Internet: WWW.Otak.COM

Washington State Department of Transportation

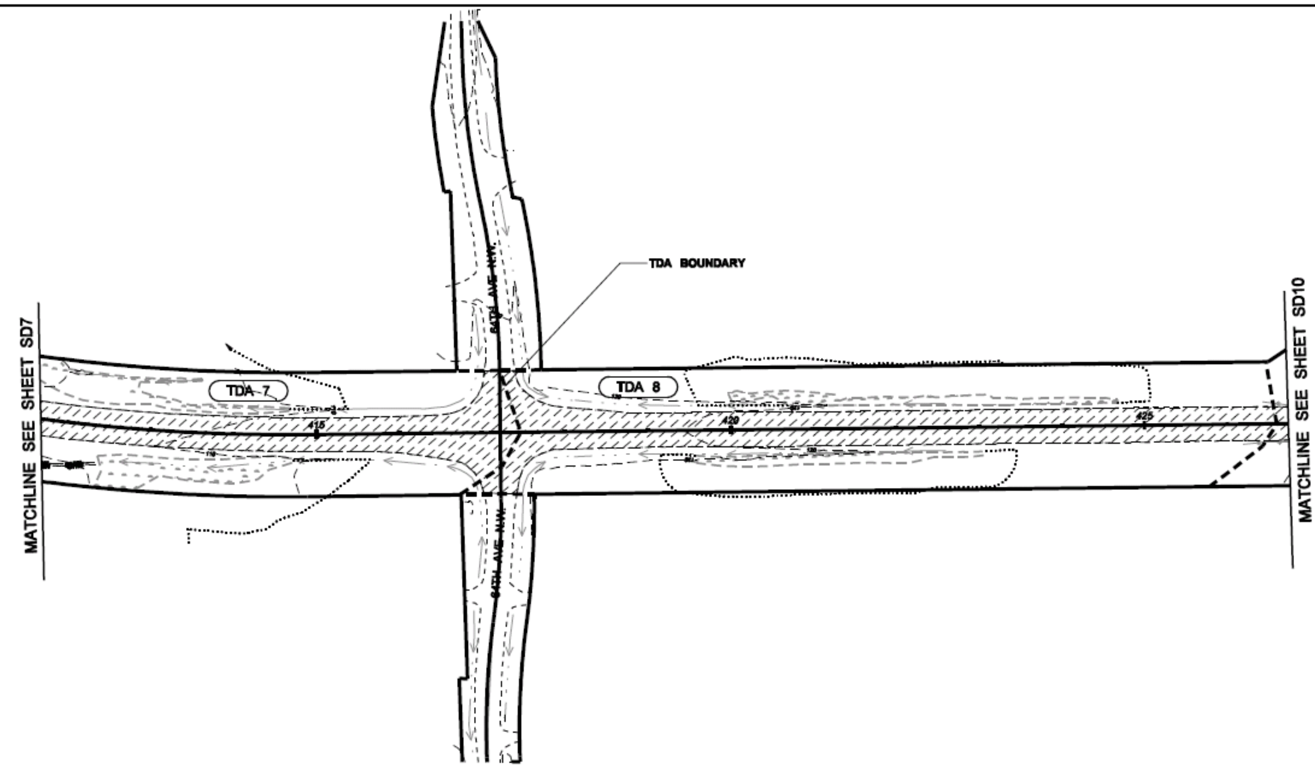
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 7 DELINIATION

Plot 1

SD7

SHEET 7 OF 19 SHEETS



EXISTING AREA TABLE

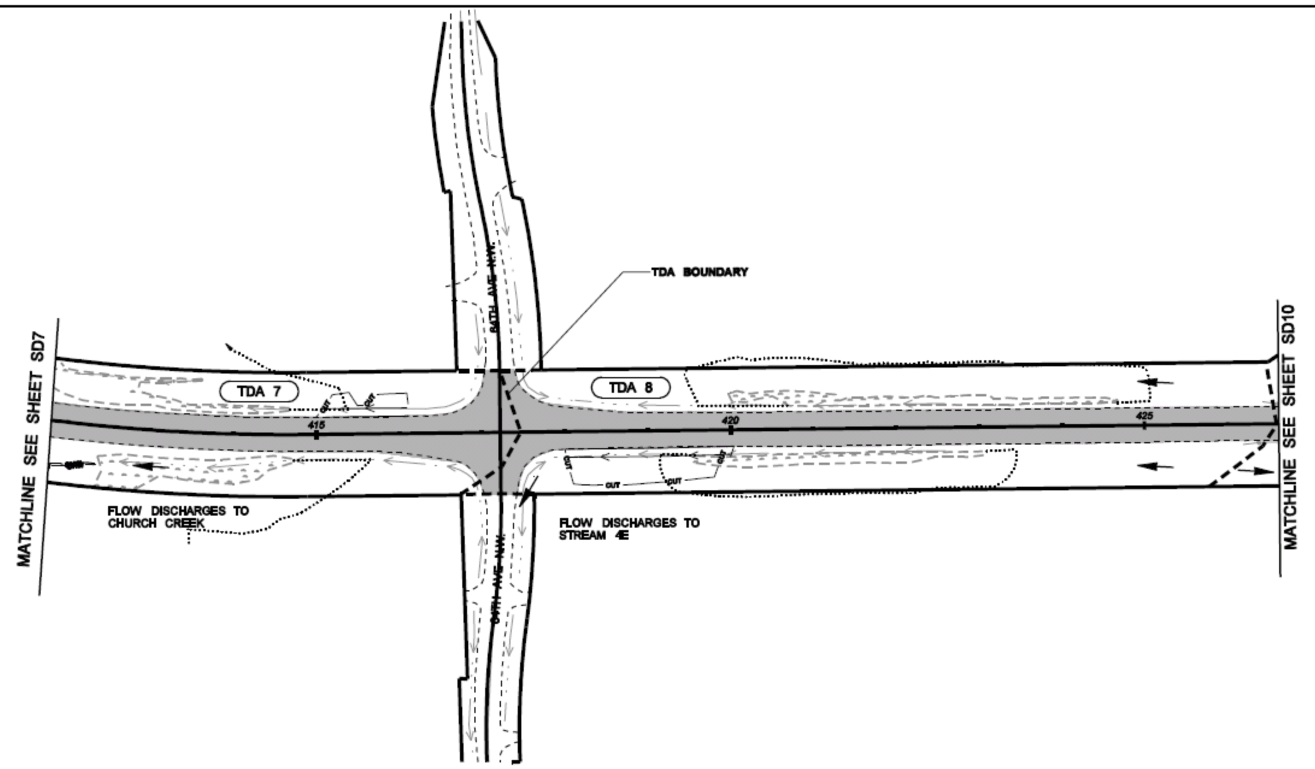
EXISTING	TDA 7 (SQ FT)	TDA 8 (SQ FT)
PERVIOUS SURFACE	348,588	94,948
IMPERVIOUS SURFACE		
POLLUTION GENERATING	119,654	41,866
NON-POLLUTION GENERATING	0	0
TOTAL	119,654	41,866
TOTAL R/W SURFACE AREA	468,242	136,814

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

0 100 200
SCALE IN FEET



PROPOSED AREA TABLE

PROPOSED	TDA 7 (SQ FT)	TDA 8 (SQ FT)
PERVIOUS SURFACE	348,540	94,785
IMPERVIOUS SURFACE		
POLLUTION GENERATING	119,702	42,029
NON-POLLUTION GENERATING	0	0
TOTAL	119,702	42,029
TOTAL R/W SURFACE AREA	468,242	136,814
NEW IMPERVIOUS SURFACE	48	163

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
- OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

0 100 200
SCALE IN FEET

FILE NAME	K:\project\31200\31238\XL2770\CADD\PS&ESheets\l2770_PS_TDA_SN.dgn
TIME	11:30:47 AM
DATE	6/20/2008
PLOTTED BY	charlinet
DESIGNED BY	J. ANDREWS
ENTERED BY	C. FOX
CHECKED BY	
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO. | LOCATION NO.

DATE
P.E. STAMP BOX

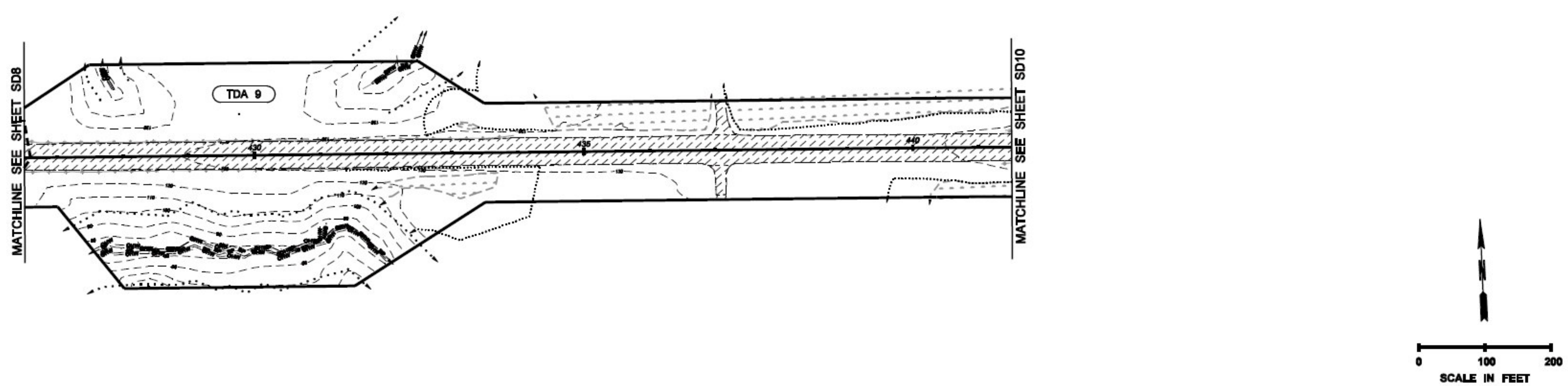
otak Incorporated
10230 NE Points Drive
Suite 400
Kirkland, Washington 98033
Phone: (425) 822-4446
FAX (425) 827-9577
Internet: WWW.Otak.COM

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 7 & 8 DELINEATION

Plot 2
SD8
SHEET 8 OF 19 SHEETS

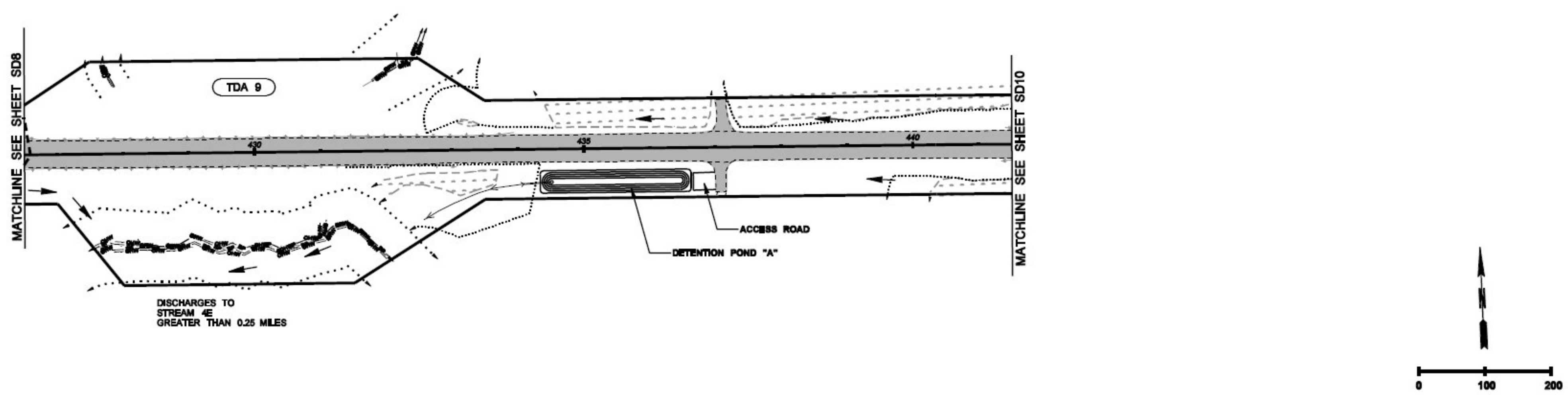


EXISTING AREA TABLE	
EXISTING	TDA 9 (SQ FT)
PERVIOUS SURFACE	777,838
IMPERVIOUS SURFACE	
POLLUTION GENERATING	261,901
NON-POLLUTION GENERATING	0
TOTAL	261,901
TOTAL R/W SURFACE AREA	1,039,739

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE



PROPOSED AREA TABLE	
PROPOSED	TDA 9 (SQ FT)
PERVIOUS SURFACE	751,397
IMPERVIOUS SURFACE	
POLLUTION GENERATING	288,342
NON-POLLUTION GENERATING	0
TOTAL	288,342
TOTAL R/W SURFACE AREA	1,039,739
NEW IMPERVIOUS SURFACE	26,441

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

EXISTING WETLAND BOUNDARY
EXISTING WETLAND SYMBOL
EXISTING CONTOUR
– FILL — NEW FILL LINE
– CUT — NEW CUT LINE
- OHW — OHW — ORDINARY HIGH WATER MARK
EXISTING STREAM BUFFER
EXISTING WETLAND BUFFER
EXISTING DITCH
NEW DITCH
TDA FLOW ARROW
ECOLOGY EMBANKMENT
RIGHT OF WAY
NEW EDGE OF PAVEMENT
EXISTING PAVED EDGE
EXISTING GRAVEL EDGE

FILE NAME	K:\project\31200\31238\XL2770\CADD\PS&ESheets\l2770_PS_TDA_SN.dgn
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DATE	6/20/2008
PLOTTED BY	chartinet
DESIGNED BY	J. ANDREWS
ENTERED BY	C. FOX
CHECKED BY	
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

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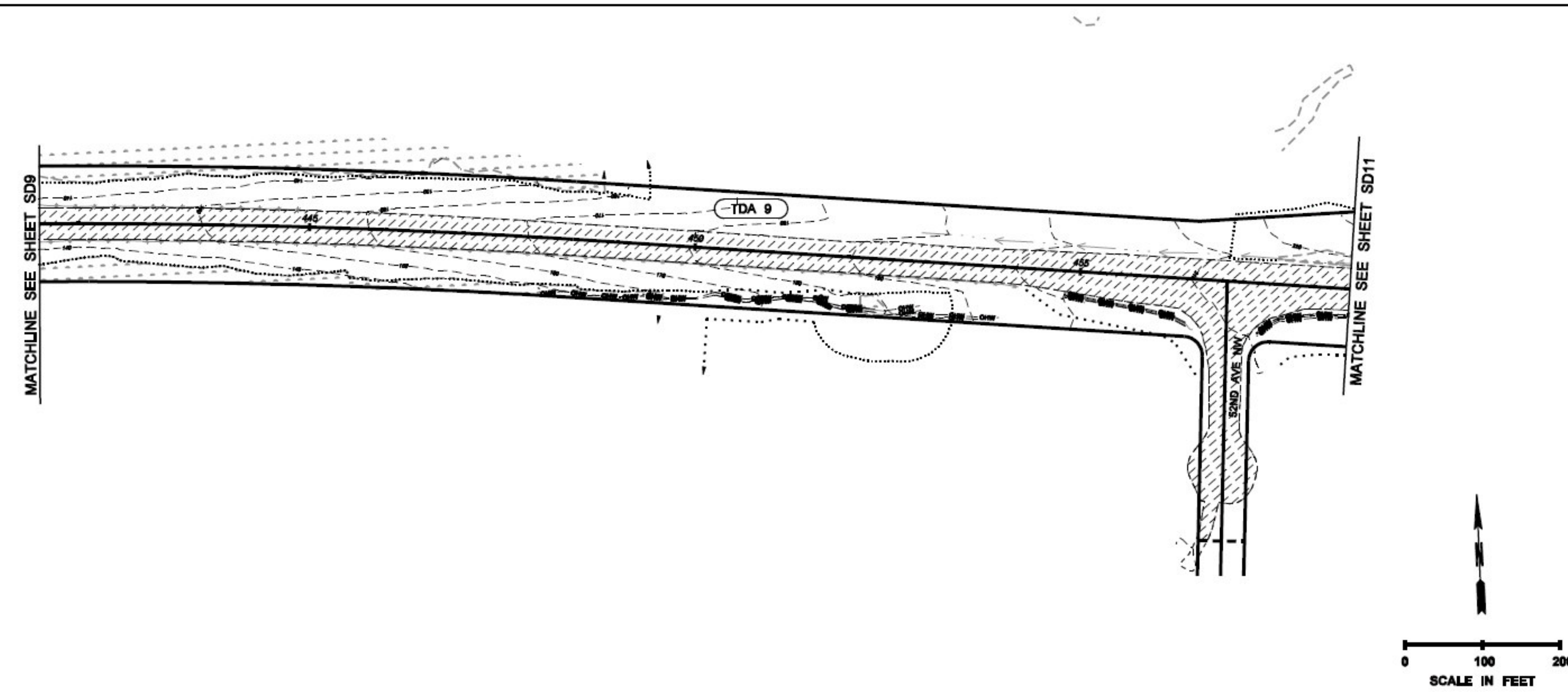
Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 9 DELINEATION

Plot 3
SD9
SHEET 9 OF 19 SHEETS



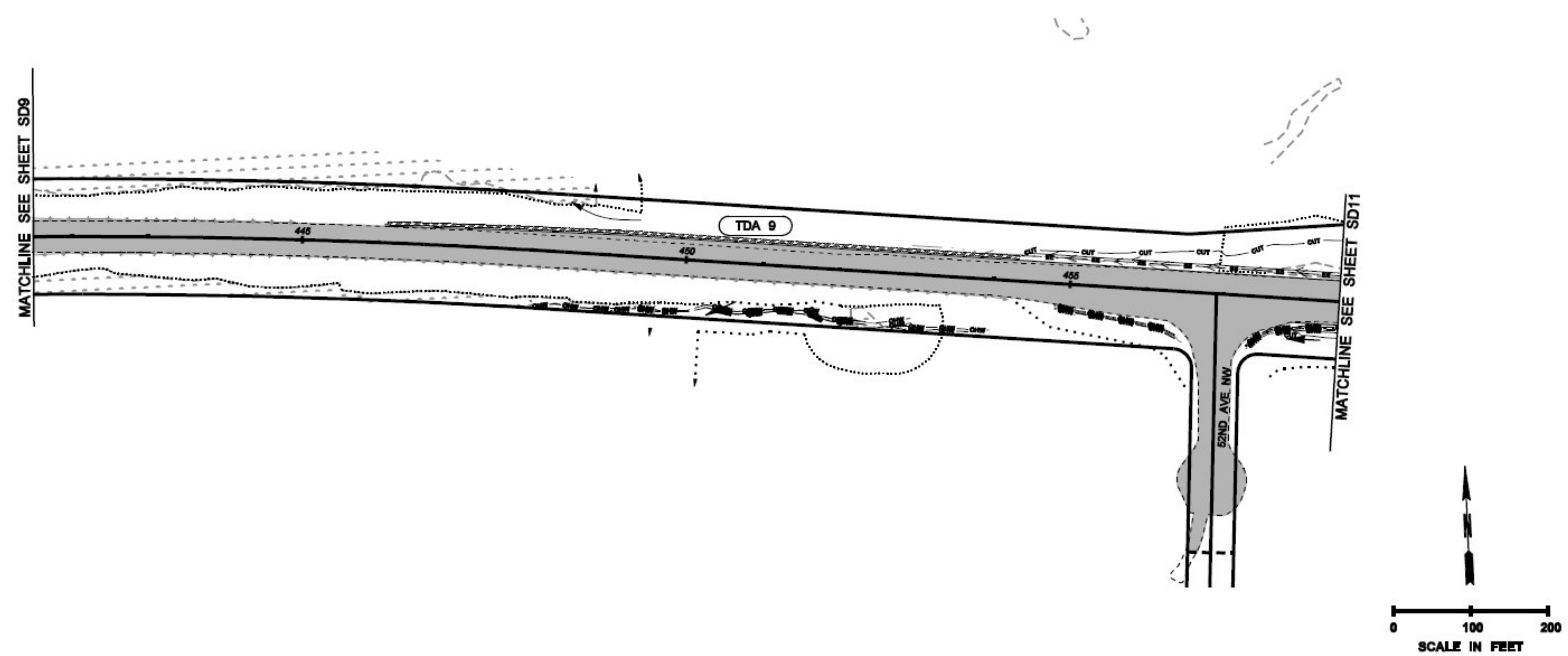
EXISTING AREA TABLE

EXISTING	TDA 9 (SQ FT)
PERVIOUS SURFACE	777,838
IMPERVIOUS SURFACE	
POLLUTION GENERATING	261,901
NON-POLLUTION GENERATING	0
TOTAL	261,901
TOTAL R/W SURFACE AREA	1,039,739

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE



PROPOSED AREA TABLE

PROPOSED	TDA 9 (SQ FT)
PERVIOUS SURFACE	751,397
IMPERVIOUS SURFACE	
POLLUTION GENERATING	288,342
NON-POLLUTION GENERATING	0
TOTAL	288,342
TOTAL R/W SURFACE AREA	1,039,739
NEW IMPERVIOUS SURFACE	26,411

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
- OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

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PLOTTED BY	chartinet
DESIGNED BY	J. ANDREWS
ENTERED BY	C. FOX
CHECKED BY	
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

JOB NUMBER

CONTRACT NO. | LOCATION NO.

DATE

P.E. STAMP BOX

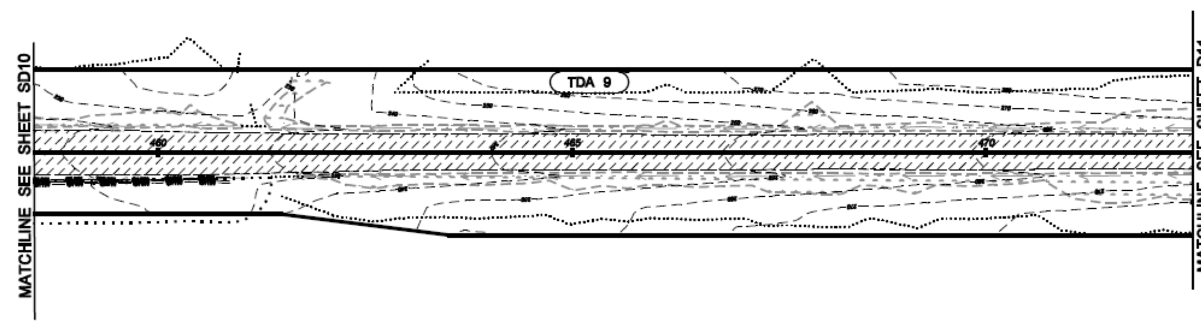
otak Incorporated
10230 NE Points Drive
Suite 400
Kirkland, Washington 98033
Phone: (425) 822-4446
FAX (425) 827-9577
Internet: WWW.Otak.COM

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 9 DELINEATION CONTINUED

Plot 4
SD10
SHEET 10 OF 19 SHEETS

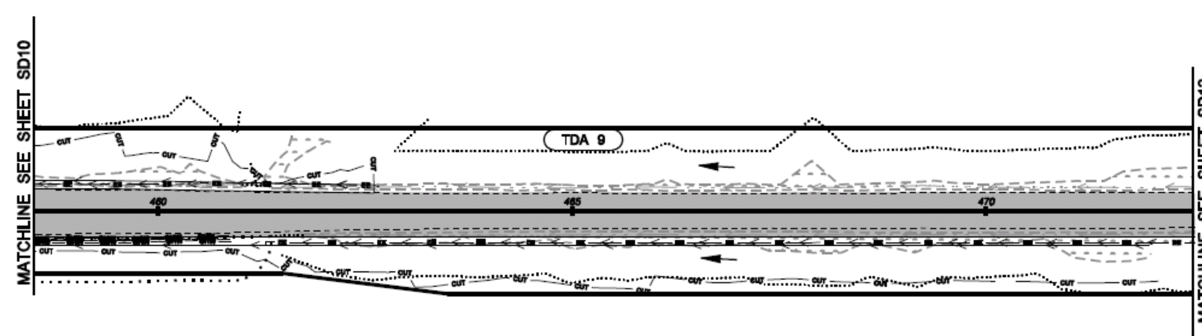


EXISTING AREA TABLE	
EXISTING	TDA 9 (SQ FT)
PERVIOUS SURFACE	777,838
IMPERVIOUS SURFACE	
POLLUTION GENERATING	261,901
NON-POLLUTION GENERATING	0
TOTAL	261,901
TOTAL R/W SURFACE AREA	1,039,739

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE



PROPOSED AREA TABLE	
PROPOSED	TDA 9 (SQ FT)
PERVIOUS SURFACE	751,397
IMPERVIOUS SURFACE	
POLLUTION GENERATING	288,342
NON-POLLUTION GENERATING	0
TOTAL	288,342
TOTAL R/W SURFACE AREA	1,039,739
NEW IMPERVIOUS SURFACE	26,411

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
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- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

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PLOTTED BY	charlinet
DESIGNED BY	J. ANDREWS
ENTERED BY	C. FOX
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PROJ. ENGR.	
REGIONAL ADM.	

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Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 9 DELINEATION CONTINUED

Plot 5

SD11

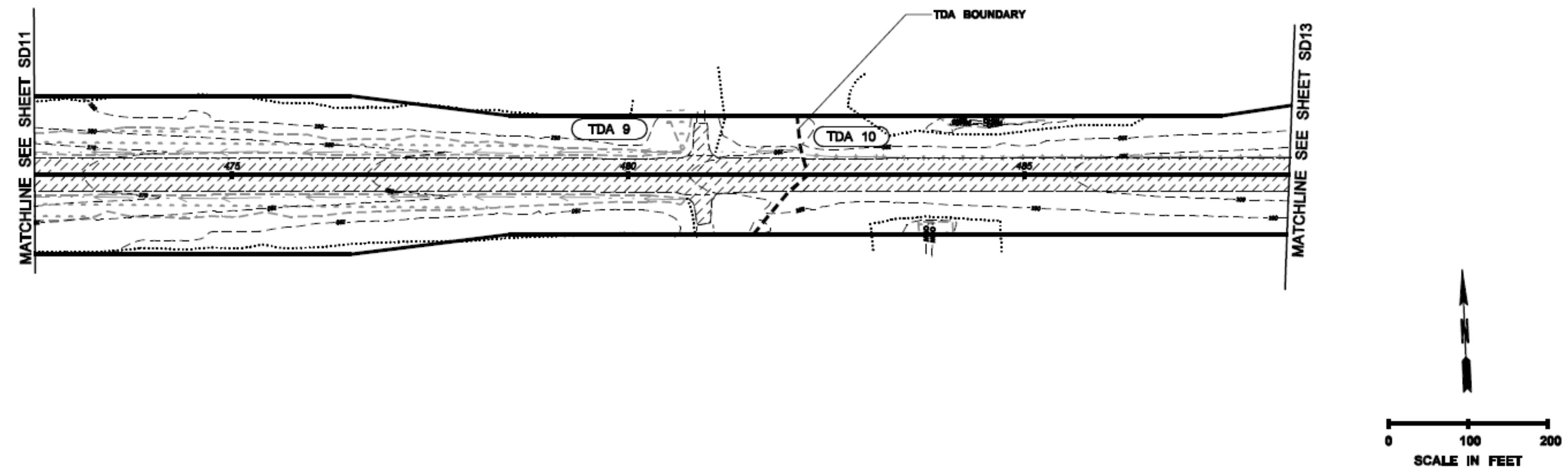
SHEET 11 OF 19 SHEETS

EXISTING AREA TABLE		
EXISTING	TDA 9 (SQ FT)	TDA 10 (SQ FT)
PERVIOUS SURFACE	777,838	225,439
IMPERVIOUS SURFACE		
POLLUTION GENERATING	261,901	94,676
NON-POLLUTION GENERATING	0	0
TOTAL	261,901	94,676
TOTAL R/W SURFACE AREA	1,039,739	320,115

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

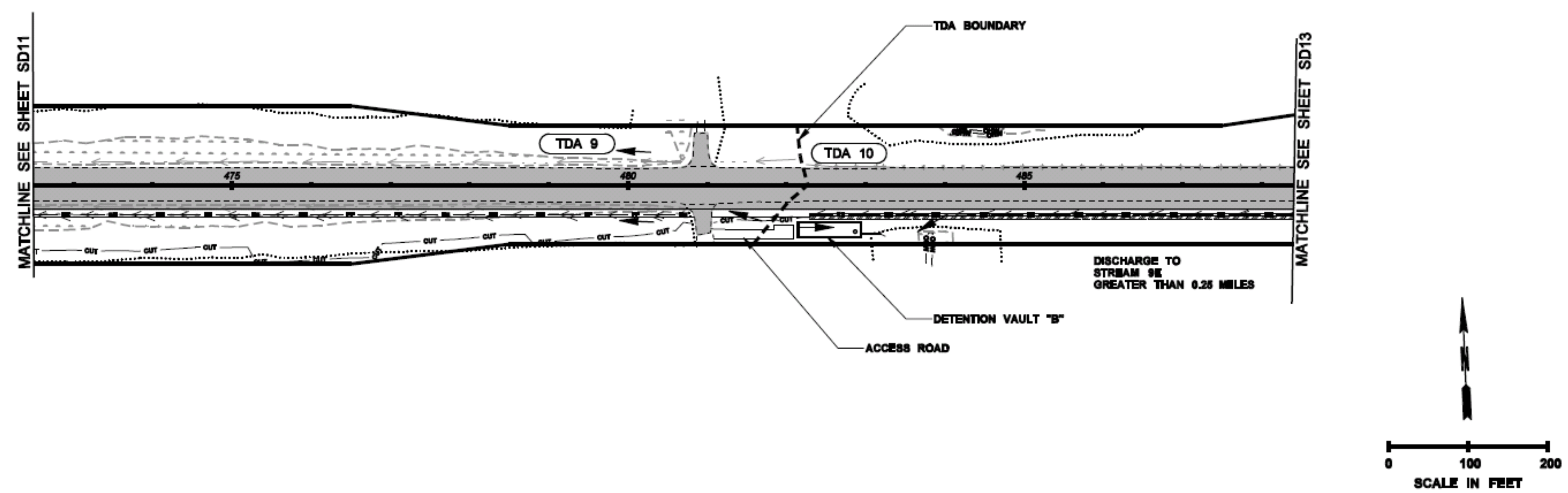


PROPOSED AREA TABLE		
PROPOSED	TDA 9 (SQ FT)	TDA 10 (SQ FT)
PERVIOUS SURFACE	751,397	204,002
IMPERVIOUS SURFACE		
POLLUTION GENERATING	288,342	116,113
NON-POLLUTION GENERATING	0	0
TOTAL	288,342	116,113
TOTAL R/W SURFACE AREA	1,039,739	320,115
NEW IMPERVIOUS SURFACE	26,411	21,437

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE



LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
- OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

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ENTERED BY	C. FOX
CHECKED BY	
PROJ. ENGR.	
REGIONAL ADM.	

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SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 9 & 10 DELINEATION

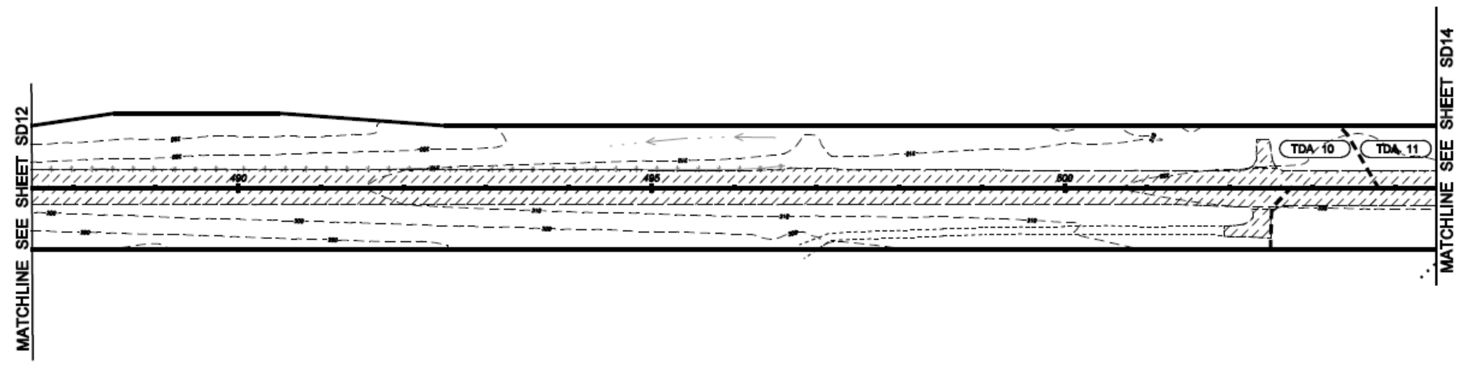
Plot 6

SD12

SHEET 12 OF 19 SHEETS

EXISTING AREA TABLE

EXISTING	TDA 10 (SQ FT)	TDA 11 (SQ FT)
PERVIOUS SURFACE	225,439	157,833
IMPERVIOUS SURFACE		
POLLUTION GENERATING	94,676	87,007
NON-POLLUTION GENERATING	0	0
TOTAL	94,676	87,007
TOTAL R/W SURFACE AREA	320,115	244,840



POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

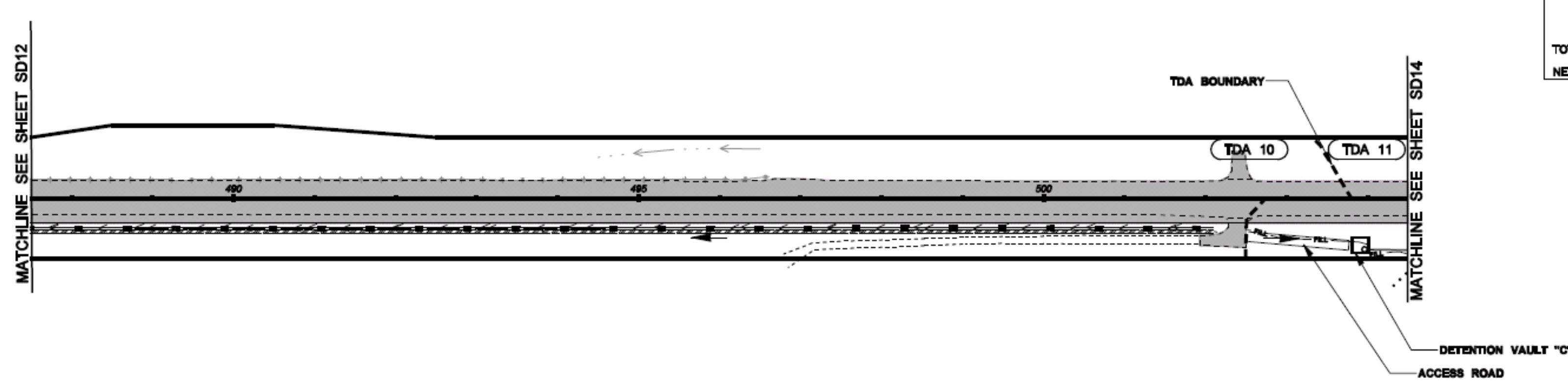
NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

0 100 200
SCALE IN FEET

PROPOSED AREA TABLE

PROPOSED	TDA 10 (SQ FT)	TDA 11 (SQ FT)
PERVIOUS SURFACE	204,002	149,358
IMPERVIOUS SURFACE		
POLLUTION GENERATING	116,113	95,482
NON-POLLUTION GENERATING	0	0
TOTAL	116,113	95,482
TOTAL R/W SURFACE AREA	320,115	244,840
NEW IMPERVIOUS SURFACE	21,437	8,475



POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

EXISTING WETLAND BOUNDARY
EXISTING WETLAND SYMBOL
EXISTING CONTOUR
FILL — NEW FILL LINE
CUT — NEW CUT LINE
OHW — OHW — ORDINARY HIGH WATER MARK
EXISTING STREAM BUFFER
EXISTING WETLAND BUFFER
EXISTING DITCH
NEW DITCH
TDA FLOW ARROW
ECOLOGY EMBANKMENT
RIGHT OF WAY
NEW EDGE OF PAVEMENT
EXISTING PAVED EDGE
EXISTING GRAVEL EDGE

0 100 200
SCALE IN FEET

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DESIGNED BY	J. ANDREWS
ENTERED BY	C. FOX
CHECKED BY	
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.
JOB NUMBER
CONTRACT NO. | LOCATION NO.

P.E. STAMP BOX | DATE

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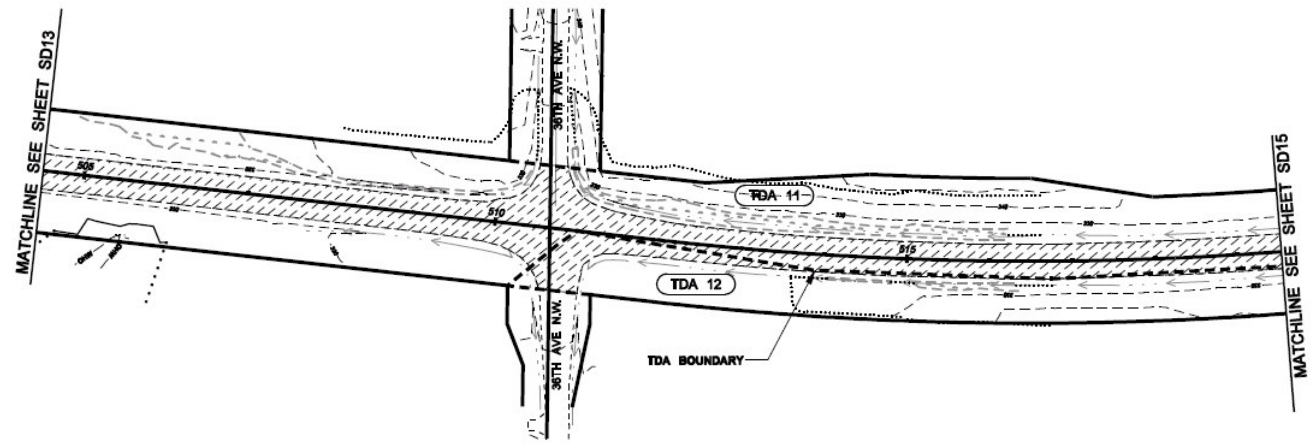
Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 10 & 11 DELINEATION

Plot 7
SD13
SHEET 13 OF 19 SHEETS



EXISTING AREA TABLE

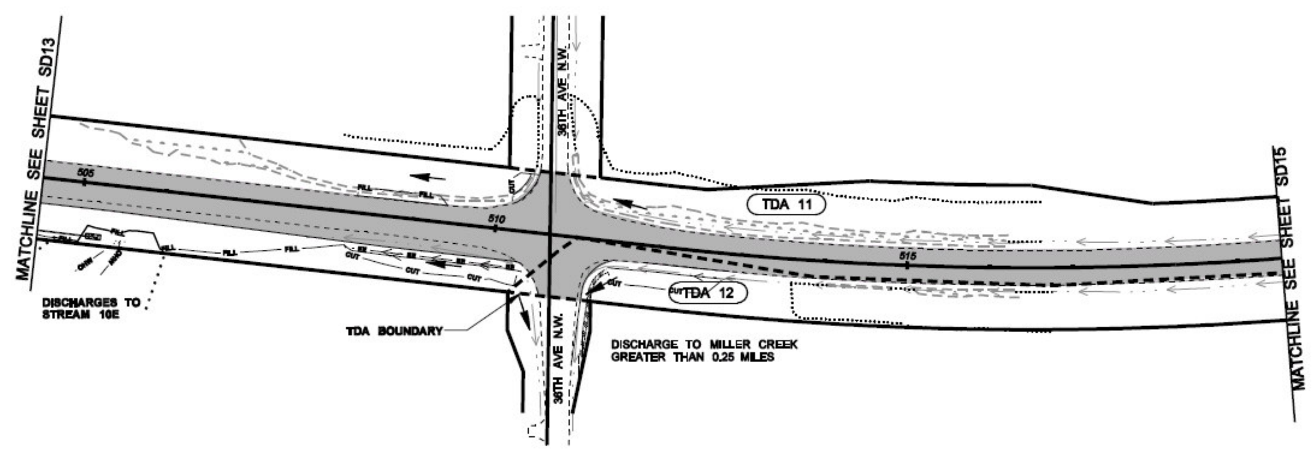
EXISTING	TDA 11 (SQ FT)	TDA 12 (SQ FT)
PERVIOUS SURFACE	157,833	61,804
IMPERVIOUS SURFACE		
POLLUTION GENERATING	87,007	8,849
NON-POLLUTION GENERATING	0	0
TOTAL	87,007	8,849
TOTAL R/W SURFACE AREA	244,840	70,653

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

0 100 200
SCALE IN FEET



PROPOSED AREA TABLE

PROPOSED	TDA 11 (SQ FT)	TDA 12 (SQ FT)
PERVIOUS SURFACE	149,358	61,278
IMPERVIOUS SURFACE		
POLLUTION GENERATING	95,482	9,375
NON-POLLUTION GENERATING	0	0
TOTAL	95,482	9,375
TOTAL R/W SURFACE AREA	244,840	70,653
NEW IMPERVIOUS SURFACE	8,475	526

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

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- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
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- OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

0 100 200
SCALE IN FEET

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PLOTTED BY	charlinet			
DESIGNED BY	J. ANDREWS			
ENTERED BY	C. FOX			
CHECKED BY				
PROJ. ENGR.				
REGIONAL ADM.		REVISION	DATE	BY

REGION NO.	STATE	FED.AID PROJ.NO.
10	WASH	
JOB NUMBER		
CONTRACT NO.		LOCATION NO.

DATE
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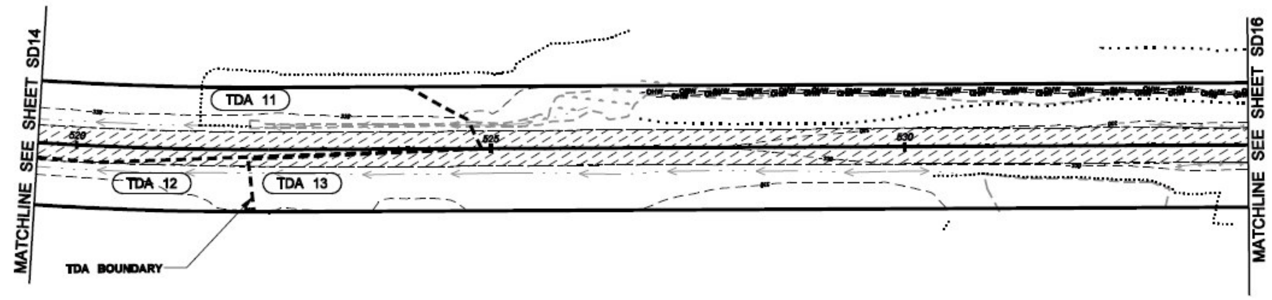
Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 11 & 12 DELINEATION

Plot 8
SD14
SHEET 14 OF 19 SHEETS



EXISTING AREA TABLE

EXISTING	TDA 11 (SQ FT)	TDA 12 (SQ FT)	TDA 13 (SQ FT)
PERVIOUS SURFACE	157,833	61,804	411,900
IMPERVIOUS SURFACE			
POLLUTION GENERATING	87,007	8,849	148,086
NON-POLLUTION GENERATING	0	0	0
TOTAL	87,007	8,849	148,086
TOTAL R/W SURFACE AREA	244,840	70,653	559,986

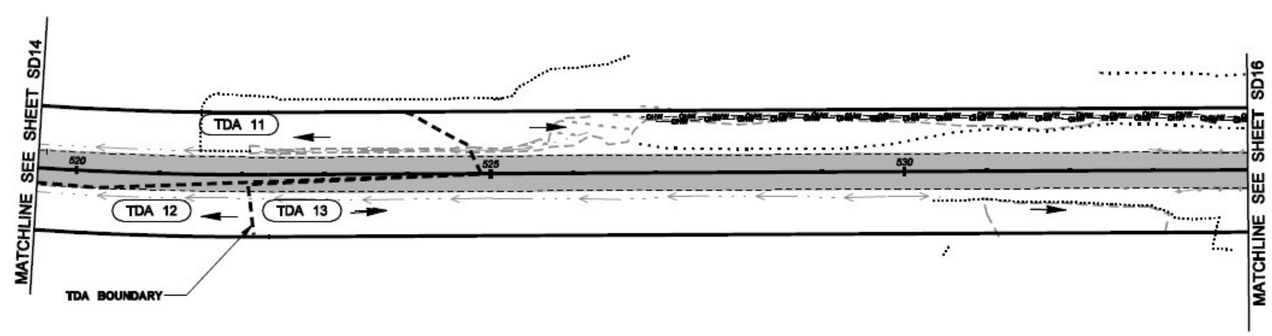
POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

N

0 100 200
SCALE IN FEET



PROPOSED AREA TABLE

PROPOSED	TDA 11 (SQ FT)	TDA 12 (SQ FT)	TDA 13 (SQ FT)
PERVIOUS SURFACE	149,358	61,278	402,568
IMPERVIOUS SURFACE			
POLLUTION GENERATING	95,482	9,375	157,418
NON-POLLUTION GENERATING	0	0	0
TOTAL	95,482	9,375	157,418
TOTAL R/W SURFACE AREA	244,840	70,653	559,986
NEW IMPERVIOUS SURFACE	8,475	526	9,332

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
- OHW — OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
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- RIGHT OF WAY
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- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

N

0 100 200
SCALE IN FEET

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DESIGNED BY	J. ANDREWS
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PROJ. ENGR.	
REGIONAL ADM.	

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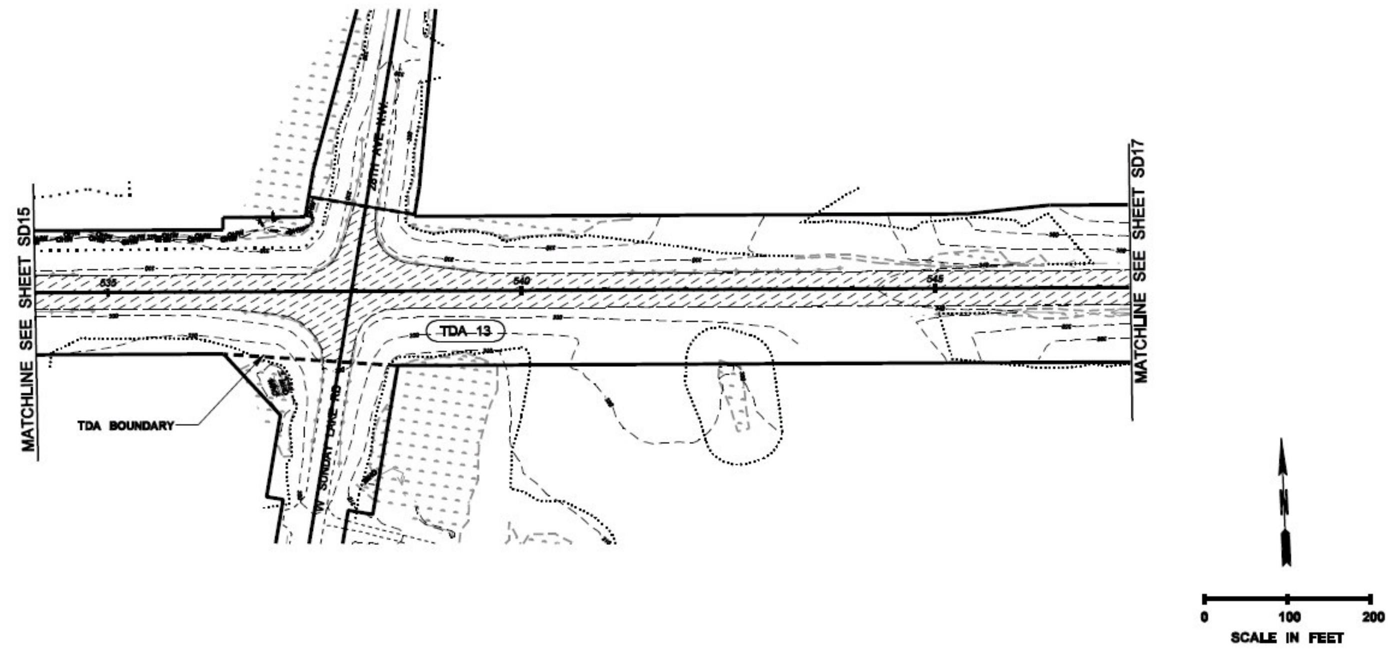
SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 11, 12 & 13 DELINEATION

Plot 9

SD15

SHEET 15 OF 19 SHEETS



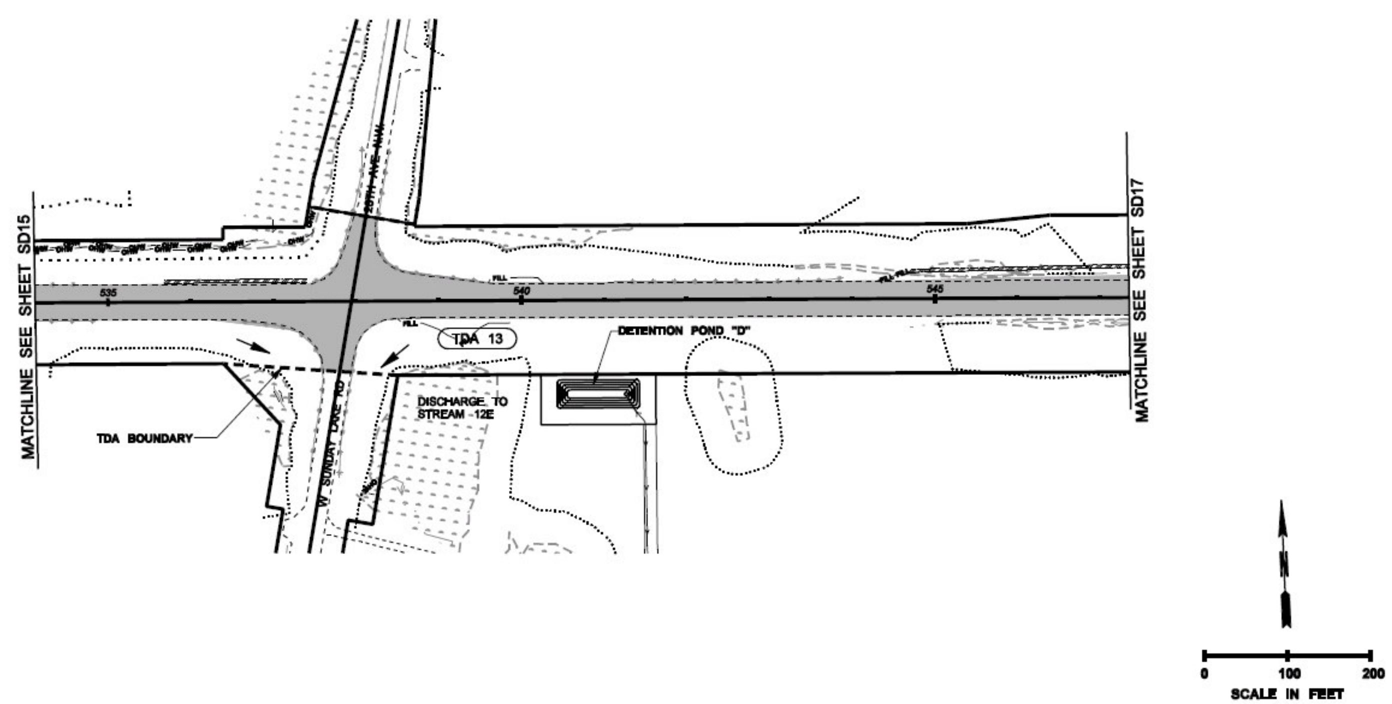
EXISTING AREA TABLE

EXISTING	TDA 13 (SQ FT)
PERVIOUS SURFACE	411,900
IMPERVIOUS SURFACE	
POLLUTION GENERATING	148,086
NON-POLLUTION GENERATING	0
TOTAL	148,086
TOTAL R/W SURFACE AREA	559,986

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE



PROPOSED AREA TABLE

PROPOSED	TDA 13 (SQ FT)
PERVIOUS SURFACE	402,568
IMPERVIOUS SURFACE	
POLLUTION GENERATING	157,418
NON-POLLUTION GENERATING	0
TOTAL	157,418
TOTAL R/W SURFACE AREA	559,986
NEW IMPERVIOUS SURFACE	9,332

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- NEW FILL LINE
- NEW CUT LINE
- ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- ECOLOGY EMBANKMENT
- RIGHT OF WAY
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SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 13 DELINEATION CONTINUED

Plot 10

SD16

SHEET 16 OF 19 SHEETS

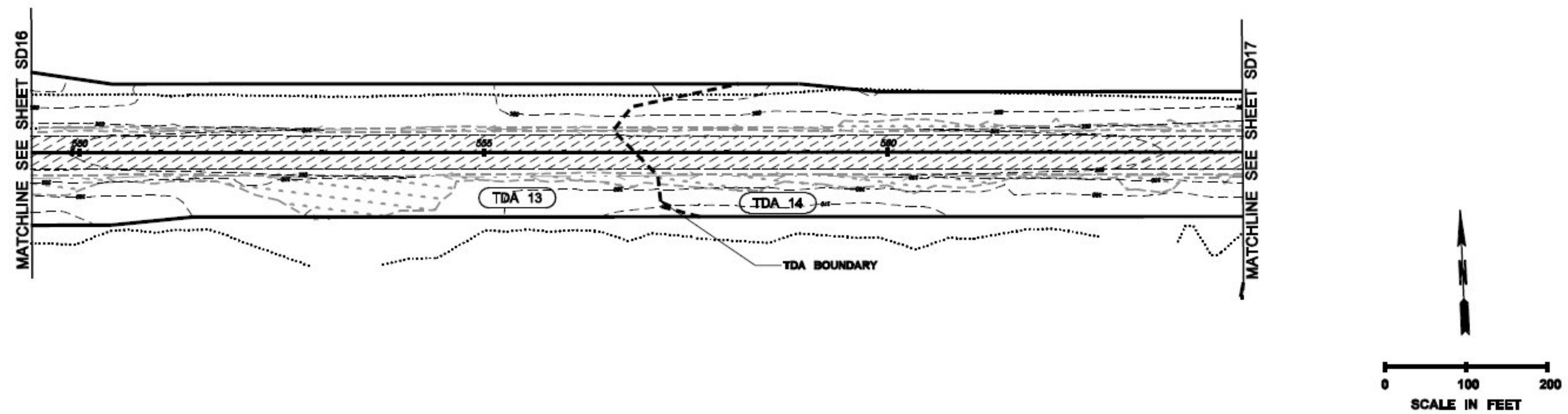
EXISTING AREA TABLE

EXISTING	TDA 13 (SQ FT)	TDA 14 (SQ FT)
PERVIOUS SURFACE	411,900	216,152
IMPERVIOUS SURFACE		
POLLUTION GENERATING	148,086	87,209
NON-POLLUTION GENERATING	0	0
TOTAL	148,086	87,209
TOTAL R/W SURFACE AREA	559,986	303,361

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE



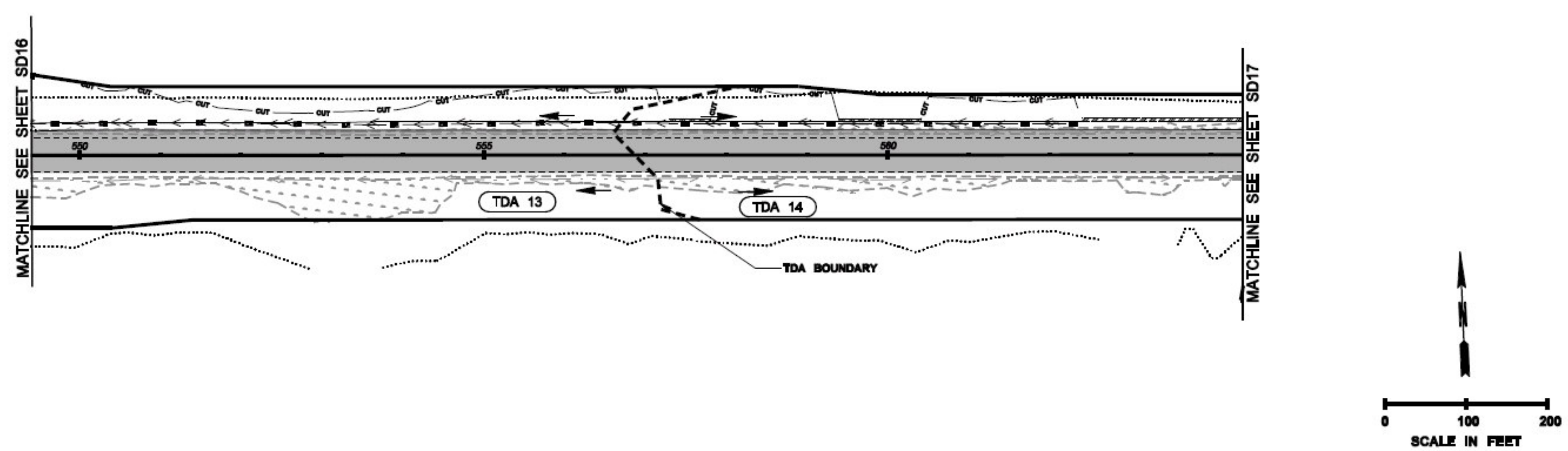
PROPOSED AREA TABLE

PROPOSED	TDA 13 (SQ FT)	TDA 14 (SQ FT)
PERVIOUS SURFACE	402,568	201,500
IMPERVIOUS SURFACE		
POLLUTION GENERATING	157,418	101,861
NON-POLLUTION GENERATING	0	0
TOTAL	157,418	101,861
TOTAL R/W SURFACE AREA	559,986	303,361
NEW IMPERVIOUS SURFACE	9,332	14,652

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE



LEGEND:

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- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
- OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
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- NEW DITCH
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- ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

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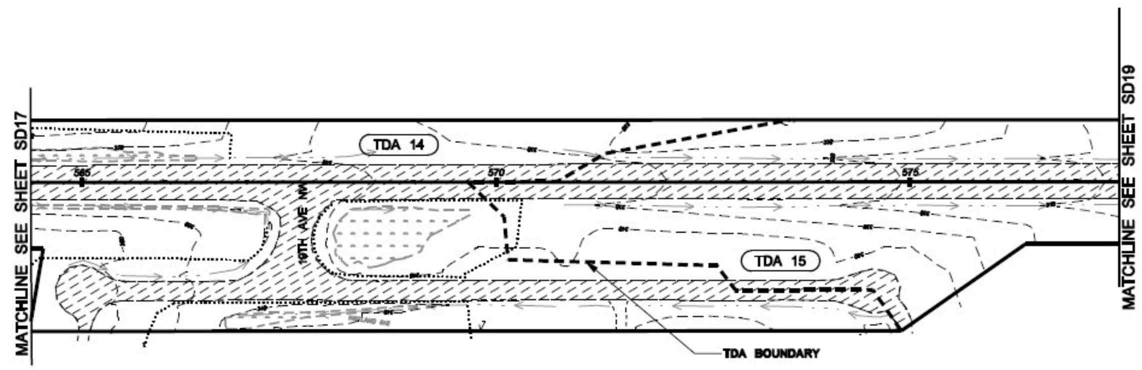
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 13 & 14 DELINEATION

Plot 11

SD17

SHEET 17 OF 19 SHEETS



EXISTING AREA TABLE		
EXISTING	TDA 14 (SQ FT)	TDA 15 (SQ FT)
PERVIOUS SURFACE	216,152	376,658
IMPERVIOUS SURFACE		
POLLUTION GENERATING	87,209	152,826
NON-POLLUTION GENERATING	0	0
TOTAL	87,209	152,826
TOTAL R/W SURFACE AREA	303,361	529,484

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

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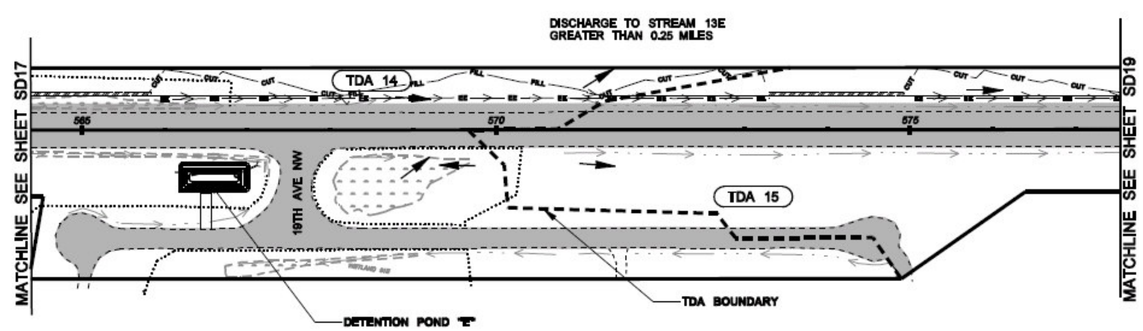
SCALE IN FEET



PROPOSED AREA TABLE		
PROPOSED	TDA 14 (SQ FT)	TDA 15 (SQ FT)
PERVIOUS SURFACE	201,500	347,753
IMPERVIOUS SURFACE		
POLLUTION GENERATING	101,861	181,731
NON-POLLUTION GENERATING	0	0
TOTAL	101,861	181,731
TOTAL R/W SURFACE AREA	303,361	529,484
NEW IMPERVIOUS SURFACE	14,652	28,905

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
- OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

0 100 200
SCALE IN FEET

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DATE	6/20/2008
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DESIGNED BY	J. ANDREWS
ENTERED BY	C. FOX
CHECKED BY	
PROJ. ENGR.	
REGIONAL ADM.	

REVISION | DATE | BY

REGION NO. 10 | STATE WASH | FED.AID PROJ.NO.

JOB NUMBER

CONTRACT NO. | LOCATION NO.

DATE

P.E. STAMP BOX

otak Incorporated
10230 NE Points Drive
Suite 400
Kirkland, Washington 98033
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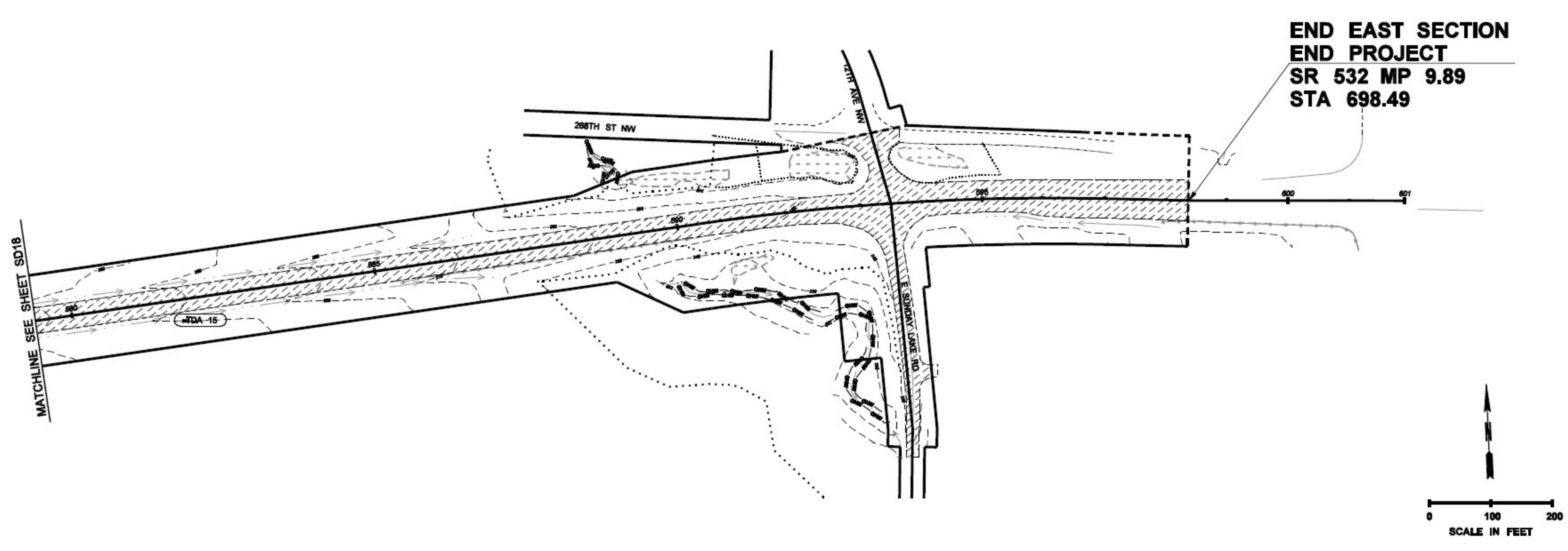
Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 14 & 15 DELINEATION

Plot 12
SD18
SHEET 18 OF 19 SHEETS



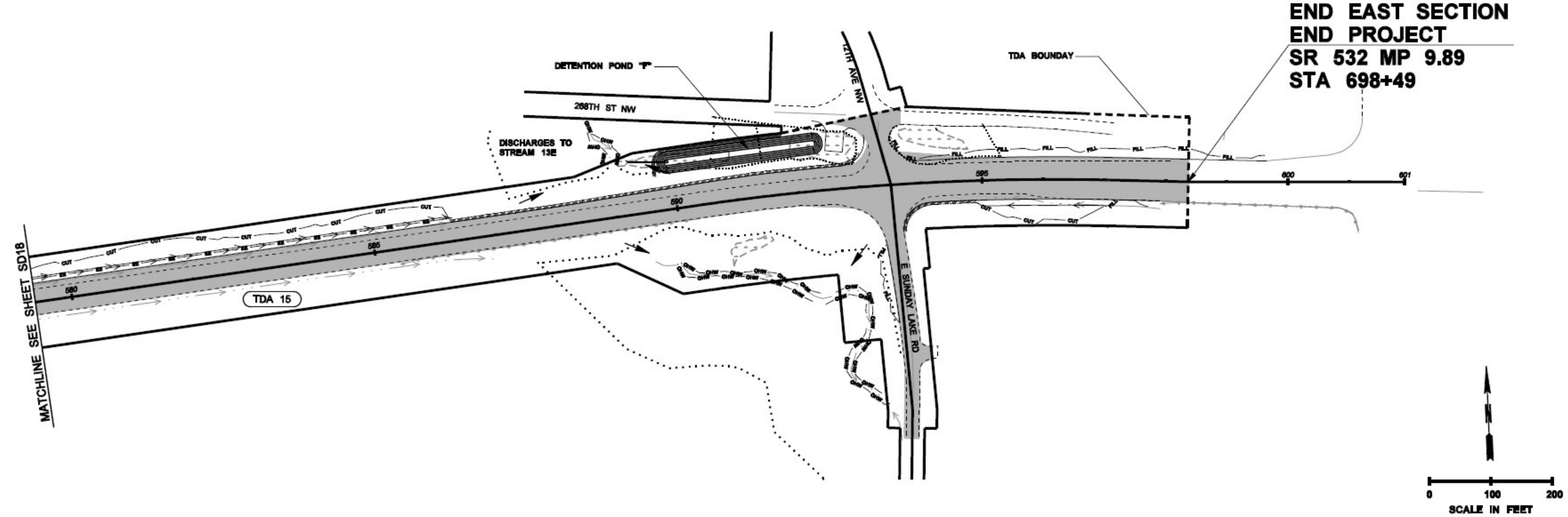
EXISTING AREA TABLE

EXISTING	TDA 15 (SQ FT)
PERVIOUS SURFACE	376,658
IMPERVIOUS SURFACE	
POLLUTION GENERATING	152,826
NON-POLLUTION GENERATING	0
TOTAL	152,826
TOTAL R/W SURFACE AREA	529,484

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE



PROPOSED AREA TABLE

PROPOSED	TDA 15 (SQ FT)
PERVIOUS SURFACE	347,753
IMPERVIOUS SURFACE	
POLLUTION GENERATING	181,731
NON-POLLUTION GENERATING	0
TOTAL	181,731
TOTAL R/W SURFACE AREA	529,484
NEW IMPERVIOUS SURFACE	28,905

POLLUTION GENERATING IMPERVIOUS SURFACE (PGIS)

NON-POLLUTION GENERATING IMPERVIOUS SURFACE (NPGIS)

PERVIOUS SURFACE

LEGEND:

LEGEND:

- EXISTING WETLAND BOUNDARY
- EXISTING WETLAND SYMBOL
- EXISTING CONTOUR
- FILL — NEW FILL LINE
- CUT — NEW CUT LINE
- OHW — OHW — ORDINARY HIGH WATER MARK
- EXISTING STREAM BUFFER
- EXISTING WETLAND BUFFER
- EXISTING DITCH
- NEW DITCH
- TDA FLOW ARROW
- ECOLOGY EMBANKMENT
- RIGHT OF WAY
- NEW EDGE OF PAVEMENT
- EXISTING PAVED EDGE
- EXISTING GRAVEL EDGE

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DATE	6/20/2008				10 WASH	
PLOTTED BY	charlinet					
DESIGNED BY	J. ANDREWS				JOB NUMBER	
ENTERED BY	C. FOX					
CHECKED BY					CONTRACT NO.	LOCATION NO.
PROJ. ENGR.						
REGIONAL ADM.		REVISION	DATE	BY		

DATE

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DATE

Washington State Department of Transportation

SR 532 CORRIDOR IMPROVEMENTS
CAMANO ISLAND TO I-5
EAST SECTION 270TH ST NW TO 12TH AVE NW

TDA 15 DELINEATION CONTINUED

Plot 13

SD19

SHEET 19 OF 19 SHEETS

APPENDIX D: TDAs 1-15 ANNUAL EFFLUENT LOAD AND CONCENTRATION CALCULATIONS

LOAD CALCULATIONS

LOAD RATES	TSS	TOTAL ZINC	DISSOLVED ZINC	TOTAL COPPER	DISSOLVED COPPER
Mean annual load from untreated surfaces (lbs/acre)	565	1.1	0.4	0.2	0.053
Mean annual load from treated surfaces (lbs/acre)	45	0.28	0.2	0.065	0.035

PROJECT TOTAL	TSS	TOTAL ZINC	DISSOLVED ZINC	TOTAL COPPER	DISSOLVED COPPER
Annual effluent load from existing impervious surfaces prior to project (lbs)	22,108.45	43.04	15.65	7.83	2.07
Annual effluent load from new and existing impervious surfaces after project (lbs)	19,344.70	39.29	15.12	7.26	2.08
NET CHANGE in pollutant loads between pre- and post-project conditions (lbs)	**-2,763.76**	**-3.75**	**-0.53**	**-0.56**	**0.00**

TDA BREAKDOWN	TSS	TOTAL ZINC	DISSOLVED ZINC	TOTAL COPPER	DISSOLVED COPPER
TDA 1					
Annual effluent load from existing impervious surfaces prior to project (lbs)	1,186.50	2.31	0.84	0.42	0.11
Annual effluent load from new and existing impervious surfaces after project (lbs)	1,186.50	2.31	0.84	0.42	0.11
NET CHANGE (lbs)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
TDA 2					
Annual effluent load from existing impervious surfaces prior to project (lbs)	1,932.30	3.76	1.37	0.68	0.18
Annual effluent load from new and existing impervious surfaces after project (lbs)	1,706.45	3.40	1.27	0.62	0.17
NET CHANGE (lbs)	**-225.85**	**-0.37**	**-0.10**	**-0.06**	**-0.01**
TDA 3					
Annual effluent load from existing impervious surfaces prior to project (lbs)	1,090.45	2.12	0.77	0.39	0.10
Annual effluent load from new and existing impervious surfaces after project (lbs)	1,090.45	2.12	0.77	0.39	0.10
NET CHANGE (lbs)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
TDA 4					
Annual effluent load from existing impervious surfaces prior to project (lbs)	1,000.05	1.95	0.71	0.35	0.09
Annual effluent load from new and existing impervious surfaces after project (lbs)	863.75	1.70	0.63	0.31	0.08
NET CHANGE (lbs)	**-136.30**	**-0.24**	**-0.08**	**-0.04**	**-0.01**
TDA 5					
Annual effluent load from existing impervious surfaces prior to project (lbs)	1,966.20	3.83	1.39	0.70	0.18
Annual effluent load from new and existing impervious surfaces after project (lbs)	1,709.35	3.44	1.31	0.63	0.18
NET CHANGE (lbs)	**-256.85**	**-0.39**	**-0.09**	**-0.06**	**-0.01**
TDA 6					
Annual effluent load from existing impervious surfaces prior to project (lbs)	1,937.95	3.77	1.37	0.69	0.18
Annual effluent load from new and existing impervious surfaces after project (lbs)	1,649.35	3.43	1.36	0.64	0.19
NET CHANGE (lbs)	**-288.60**	**-0.35**	**-0.02**	**-0.05**	**0.01**
TDA 7					
Annual effluent load from existing impervious surfaces prior to project (lbs)	1,553.75	3.03	1.10	0.55	0.15
Annual effluent load from new and existing impervious surfaces after project (lbs)	1,559.40	3.04	1.10	0.55	0.15
NET CHANGE (lbs)	**5.65**	**0.01**	**0.00**	**0.00**	**0.00**
TDA 8					
Annual effluent load from existing impervious surfaces prior to project (lbs)	542.40	1.06	0.38	0.19	0.05
Annual effluent load from new and existing impervious surfaces after project (lbs)	544.10	1.06	0.39	0.19	0.05
NET CHANGE (lbs)	**1.70**	**0.00**	**0.00**	**0.00**	**0.00**
TDA 9					
Annual effluent load from existing impervious surfaces prior to project (lbs)	3,395.65	6.61	2.40	1.20	0.32
Annual effluent load from new and existing impervious surfaces after project (lbs)	2,487.10	5.31	2.17	1.00	0.31
NET CHANGE (lbs)	**-908.55**	**-1.31**	**-0.24**	**-0.20**	**-0.01**
TDA 10					
Annual effluent load from existing impervious surfaces prior to project (lbs)	1,226.05	2.39	0.87	0.43	0.12
Annual effluent load from new and existing impervious surfaces after project (lbs)	769.70	1.77	0.78	0.34	0.12
NET CHANGE (lbs)	**-456.35**	**-0.62**	**-0.09**	**-0.09**	**0.00**
TDA 11					
Annual effluent load from existing impervious surfaces prior to project (lbs)	1,130.00	2.20	0.80	0.40	0.11
Annual effluent load from new and existing impervious surfaces after project (lbs)	1,138.55	2.25	0.84	0.41	0.11
NET CHANGE (lbs)	**8.55**	**0.05**	**0.04**	**0.01**	**0.01**
TDA 12					
Annual effluent load from existing impervious surfaces prior to project (lbs)	113.00	0.22	0.08	0.04	0.01
Annual effluent load from new and existing impervious surfaces after project (lbs)	113.00	0.22	0.08	0.04	0.01
NET CHANGE (lbs)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
TDA 13					
Annual effluent load from existing impervious surfaces prior to project (lbs)	1,921.00	3.74	1.36	0.68	0.18
Annual effluent load from new and existing impervious surfaces after project (lbs)	1,738.05	3.50	1.33	0.64	0.18
NET CHANGE (lbs)	**-182.95**	**-0.24**	**-0.03**	**-0.04**	**0.00**
TDA 14					
Annual effluent load from existing impervious surfaces prior to project (lbs)	1,130.00	2.20	0.80	0.40	0.11
Annual effluent load from new and existing impervious surfaces after project (lbs)	921.70	1.94	0.78	0.36	0.11
NET CHANGE (lbs)	**-208.30**	**-0.26**	**-0.02**	**-0.04**	**0.00**
TDA 15					
Annual effluent load from existing impervious surfaces prior to project (lbs)	1,983.15	3.86	1.40	0.70	0.19
Annual effluent load from new and existing impervious surfaces after project (lbs)	1,867.25	3.82	1.48	0.71	0.20
NET CHANGE (lbs)	**-115.90**	**-0.04**	**0.08**	**0.01**	**0.02**

CONCENTRATION CALCULATIONS - Moderate Risk Projects

	TSS (mg/L)	TOTAL ZINC (ug/L)	DISSOLVED ZINC (ug/L)	TOTAL COPPER (ug/L)	DISSOLVED COPPER (ug/L)
Expected pollutant concentrations for UNTREATED runoff	93	174	62	31	7.6
Expected pollutant concentrations for TREATED runoff	6.4	40	27	7	5

PROJECT TOTAL	TSS (mg/L)	TOTAL ZINC (ug/L)	DISSOLVED ZINC (ug/L)	TOTAL COPPER (ug/L)	DISSOLVED COPPER (ug/L)
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	75.53	146.97	54.94	26.16	7.08
NET CHANGE in pollutant concentration between pre- and post-project conditions	-17.47	-27.03	-7.06	-4.84	-0.52

TDA BREAKDOWN	TSS (mg/L)	TOTAL ZINC (ug/L)	DISSOLVED ZINC (ug/L)	TOTAL COPPER (ug/L)	DISSOLVED COPPER (ug/L)
TDA 1					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	93.00	174.00	62.00	31.00	7.60
NET CHANGE	0.00	0.00	0.00	0.00	0.00
TDA 2					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	83.24	158.89	58.05	28.29	7.31
NET CHANGE	-9.76	-15.11	-3.95	-2.71	-0.29
TDA 3					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	93.00	174.00	62.00	31.00	7.60
NET CHANGE	0.00	0.00	0.00	0.00	0.00
TDA 4					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	87.16	164.96	59.64	29.38	7.42
NET CHANGE	-5.84	-9.04	-2.36	-1.62	-0.18
TDA 5					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	79.10	152.48	56.38	27.15	7.18
NET CHANGE	-13.90	-21.52	-5.62	-3.85	-0.42
TDA 6					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	68.45	136.01	52.08	24.19	6.86
NET CHANGE	-24.55	-37.99	-9.92	-6.81	-0.74
TDA 7					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	93.00	174.00	62.00	31.00	7.60
NET CHANGE	0.00	0.00	0.00	0.00	0.00
TDA 8					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	93.00	174.00	62.00	31.00	7.60
NET CHANGE	0.00	0.00	0.00	0.00	0.00
TDA 9					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	61.47	125.22	49.26	22.26	6.65
NET CHANGE	-31.53	-48.78	-12.74	-8.74	-0.95
TDA 10					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	47.10	102.97	43.45	18.28	6.22
NET CHANGE	-45.90	-71.03	-18.55	-12.72	-1.38
TDA 11					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	85.49	162.37	58.96	28.92	7.37
NET CHANGE	-7.51	-11.63	-3.04	-2.08	-0.23
TDA 12					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	93.00	174.00	62.00	31.00	7.60
NET CHANGE	0.00	0.00	0.00	0.00	0.00
TDA 13					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	79.09	152.47	56.38	27.14	7.18
NET CHANGE	-13.91	-21.53	-5.62	-3.86	-0.42
TDA 14					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	64.50	129.91	50.48	23.10	6.74
NET CHANGE	-28.50	-44.09	-11.52	-7.90	-0.86
TDA 15					
Pollutant concentation for runoff PRE-project	93.00	174.00	62.00	31.00	7.60
Pollutant concentation for runoff POST-project	73.48	143.79	54.11	25.59	7.01
NET CHANGE	-19.52	-30.21	-7.89	-5.41	-0.59

APPENDIX E: SPECIES LIFE HISTORIES

Bull Trout

Bull trout are a native char of Washington and are part of the salmonid family. There are four basic life history strategies that bull trout exhibit: anadromous (salt/freshwater migratory), adfluvial (lake dwelling), fluvial (migratory stream and river dwelling), and resident (non-migratory). All four life forms can be long lived (up to 10+ years) and all are iteroparous (adults do not die after spawning). Resident fish spend their entire life cycle in low order stream systems exhibiting little or no seasonal migrations. Fluvial fish migrate downstream to feed in larger rivers; these fish are considerably larger than resident fish due to the increased food production in higher order rivers. Adfluvial fish are similar to fluvial fish, but instead, migrate downstream to take up residence in a lacustrine (lake) environment.

There are adfluvial bull trout populations found in Baker Lake, Chester Morse Lake, and above the Gorge Dam on the Skagit River (WDFW 1998). The anadromous life form is more complex than the other forms discussed. Upstream and downstream migration timing can vary considerably. Smolts will typically move out to Puget Sound as early as late February but usually in April, May, and early June, spending the remaining spring and summer months in the marine environment. They will then return to the lower mainstem rivers to begin their spawning migration in the late summer of that same year (Kraemer 1994).

Adult bull trout generally spawn in the upper portion of watersheds. In most cases, anadromous bull trout define the upper limit of anadromous use in a watershed. Large adults have been documented over 120 river miles inland at an elevation of over 3200 feet (Kraemer 1994). Spawning in the north Puget Sound drainages has been observed as early as August and as late as November. Females will deposit anywhere from a few hundred to 5,000 eggs in their redds, depending on their size. The embryos incubate until spring; the surviving fry emerge from the redds in April-May.

Temperature may be the most influencing factor affecting bull trout distribution. Water temperatures in excess of 15°C are thought to limit bull trout distribution (Rieman and McIntyre, 1995). Bull trout spawning is more dependent on temperature than time of year; stream temperatures must drop below 8°C for spawning to commence. If stream temperatures rise above 8°C once spawning has started, spawning activities will usually slow or stop (Kraemer 1994). Water temperature also appears to be a critical factor for egg development. McPhail and Murray (1979) found that the survival to emergence for bull trout varied with water temperature: 0-20% survival in 8-10°C, 60-90% in 6°C, and 80-95% in 2-4°C.

The substrate and water depth can vary greatly between spawning sites. However, spawning generally occurs in uniform substrate 0.2 to 2.0 inches in diameter and water from 8 inches to 2 feet deep. Depending on water temperature, incubation takes about 130 days; embryo development requires the accumulation of about 635 temperature units (Meehan and Bjornn 1991). Eggs hatch around the end of January but the fry may remain in the gravel until April. This extended rearing within the interstitial spaces of the gravel makes bull trout very sensitive to increased sediment loads.

Chinook Salmon

Chinook salmon are the least abundant of the Pacific salmon. Chinook are found from southern California (Ventura River) to Point Hope, Alaska. They are most prevalent in the larger river systems (Columbia, Fraser, Skeena, Kenai, Sacramento, etc.), although they do occur in smaller coastal river drainages (Wydoski & Whitney 1979). In Washington, Chinook are found in most of the larger streams of the upper and lower Columbia River, coastal, and Puget Sound drainages.

Spawning most often occurs in mainstem rivers and larger streams where adequate substrate is located. Average fecundity for Chinook females is about 5,000 eggs (range of 2,250-7,750). Chinook are semelparous and invariably die after spawning. Depending on water temperature, incubation takes between 90-150 days with fry emergence occurring in March and April. Usually, ocean-type Chinook juveniles would feed for a short time and then migrate to the ocean, whereas, stream-type Chinook juveniles rear in freshwater for one year or more.

On average, juvenile Chinook salmon, spend about one year in fresh water between emergence from the gravel and migration to the Pacific Ocean to feed. They may start migrating during any time of year. Downstream migration of fry is generally greatest during the night, though some fish may migrate during the day (Healey 1991). They remain in the ocean to feed for anywhere from two to eight years (typically three to four) before they mature and return to their natal streams to spawn. Adults begin to ascend streams in late May and early June, with prime spawning months being July through September (Wydoski and Whitney 1979). Fish from the early run, who ascend the rivers between March and May, and whose peak spawning activity occurs in July through September, are referred to as "spring Chinook" and spawn in late summer. A race called "summer Chinook" ascends the rivers usually between June and July and begins spawning in August. Those that migrate up streams in August and September, and hit peak spawning in September and October are called "fall Chinook," which spawn as soon as they get to the spawning grounds, when water temperatures are between 42° and 58°F. After emergence, juvenile Chinook salmon remain in freshwater from a few days to three years (Wydoski and Whitney 1979).

In freshwater, invertebrates make up approximately 95 percent of a juvenile Chinook salmon's diet. Chinook generally feed on insects in the water column or drifting at the surface (Healey 1991). After emigrating from freshwater, ocean-type Chinook tend to use estuaries and coastal areas for rearing where they feed on small crustaceans and insects (Wydoski and Whitney 1979; Healey 1991). As juvenile Chinook grow, they tend to eat more larval and juvenile fishes, including herring, anchovies, pilchard, and rockfish (Wydoski and Whitney 1979).

The timing for adult Chinook to return to their natal streams is based on their race, but spawning usually occurs when water temperatures reach 42°F to 57°F. The average area of a Chinook redd is 35-55 ft^2 with a recommended available area of up to 216 ft^2 per spawning pair (Reiser and Bjornn 1979). These numbers indicate the importance of large spawning areas containing cobble-sized substrate (up to four inches in diameter). Chinook would generally seek out spawning areas of shallow to moderate depths in velocities up to 3.6 feet/second. Recommended incubation temperatures range between 41°F and 58°F (Reiser and Bjornn 1979). Because fall Chinook migrate to sea relatively quickly after emergence from the gravel, rearing habitat in fresh water is of limited concern to this race. However, spring Chinook rear in fresh water for a year or more and require certain habitat characteristics. They prefer to remain in the mainstem rivers and streams, generally seeking cover in pools, large substrate, large woody debris (LWD), and undercut banks; off-channel ponds are not typically used by Chinook for overwintering (Everest and Chapman 1972).

Steelhead Trout

The present spawning distribution of steelhead *(O. mykiss)* extends from the Kamchatka Peninsula in Asia, east through Alaska, and south to southern California. The historical range of steelhead extended at least as far south as the Mexican border (Busby et al. 1996). Anadromous forms of *O. mykiss* are called steelhead, and non-anadromous forms (fresh water resident forms) are called rainbow trout.

Steelhead exhibits perhaps the greatest diversity of life history patterns of any Pacific salmonid species (Barnhart 1986). Individuals rear in freshwater between one and four years and remain at sea between one and four years (Meehan and Bjornn 1991). Other sources indicate that steelhead can spend up to seven years in fresh water prior to smoltification and then spend up to three years in salt water prior to first spawning (Busby et al. 1996). In the Pacific Northwest, steelhead that enter freshwater systems between May and October are considered summer steelhead (stream-maturing type) and steelhead that enter fresh water between November and April are considered winter steelhead (ocean-maturing type). Summer steelhead enter fresh water in a sexually immature condition and require several months to mature and spawn; whereas, winter steelhead enter fresh water with well-developed gonads and spawn shortly thereafter. Some river basins have both summer and winter runs, but some rivers only have one type. In rivers where the two types co-occur, they are often separated by a seasonal hydraulic barrier, such as a waterfall.

Unlike the five Pacific salmon species, steelheads are iteroparous, they do not invariably die after spawning. Some significant post-spawning mortality occurs, however, a small number of steelhead adults migrate out of the river after spawning and return to spawn in subsequent years (Busby et al. 1996). The frequency of multiple spawnings is variable both within and among populations of steelhead. For North American steelhead populations north of Oregon, repeat spawning is relatively uncommon, and more than two spawning migrations are rare. In Oregon and California, the frequency of two spawning migrations is higher, but more than two spawning migrations are still unusual. Iteroparous steelhead are predominately female.

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